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Electrical World

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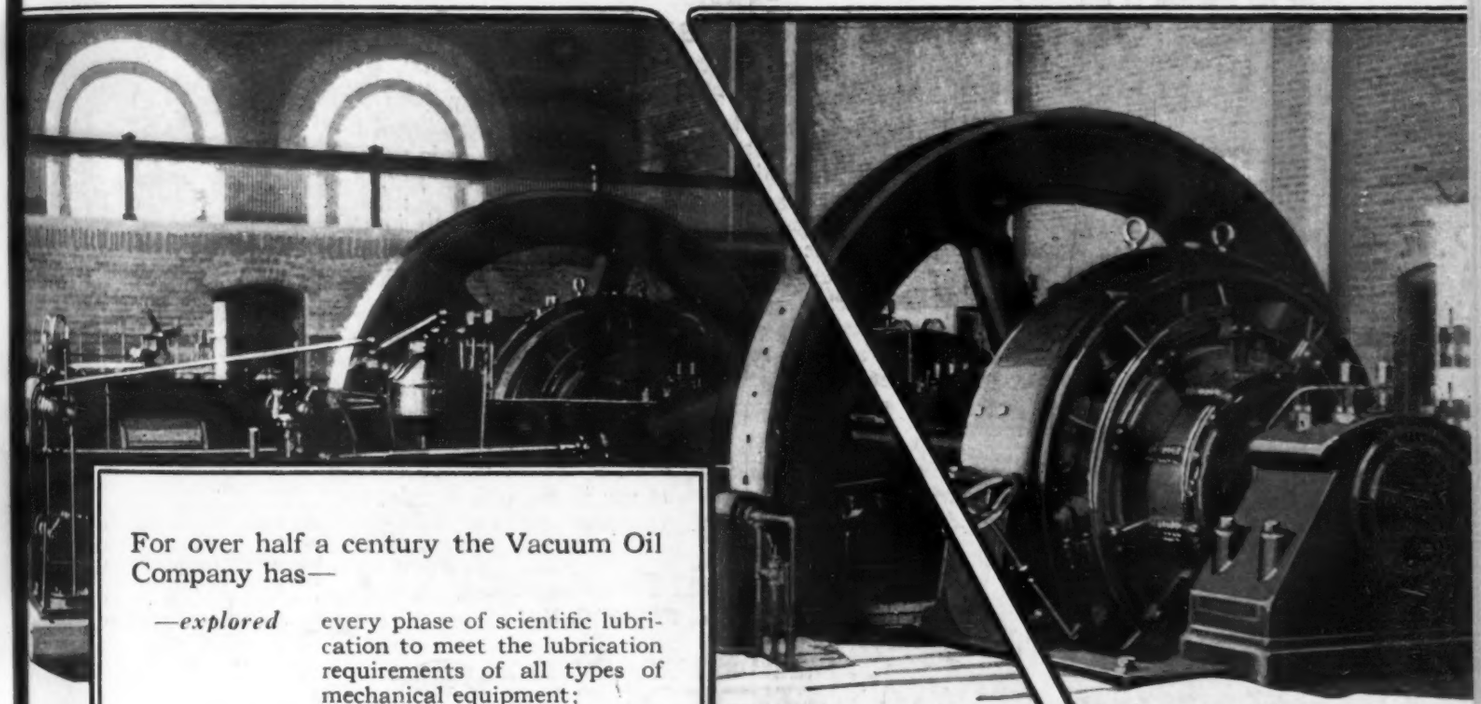

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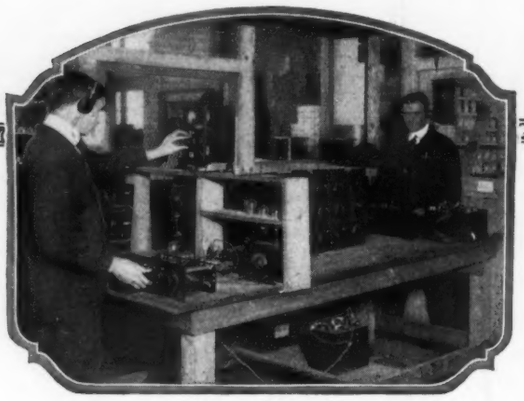

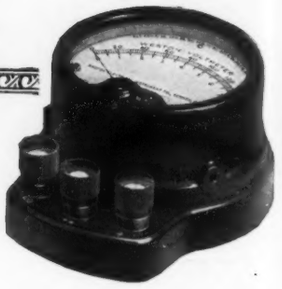

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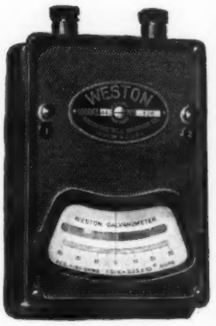

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Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

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W. H. ONKEN, JR.

Editor

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Unification, Standardization and Simplification in Industry

THERE is a general trend toward the unification of industries in order to reduce the costs of production and to save operating and administrative expenses. From this there result also an increased uniformity and improved quality of products, a simplification in practices and in lines of equipment and a degree of standardization which permits better and faster industrial progress.

Light and power companies, the railroads, the automotive industries, the newspapers, the shipping industry and many others are experiencing a fast development toward unification because it makes these industries more prosperous individually and at the same time gives the public better and cheaper commodities or service. These industries have adopted standardization methods which, under the encouragement of Secretary Hoover, have resulted in the saving of millions of dollars and have permitted them to devote their attention to new developments on a broader and freer basis. Unification places a premium on management and administration, permits business to become professionalized and eliminates waste in purchase, production and sales.

Moreover, in the public utility field at least, regulation has been established as a wise safeguard against the exploitation of the public, so that the full economic advantages of unification and standardization can be realized by the nation. The present economic moves are constructive and logical and are placing industry on a plane of efficiency heretofore unknown.

The Story of the Industry Should Be Told

THERE is romance untold back of the statement of John W. Howell, the Edison medalist: "The electric light has improved 325,000 times in quality since 1881, and lamps can be made 150 times as fast today as then." No one has publicly dramatized equally arresting facts, such as these: "The light and power industry used one billion dollars of new capital in 1924 as compared with a half billion dollars used by the railroads," or "The United States uses more power than all the rest of the world," or "Electricity is the one national commodity whose cost has continually decreased in spite of the war."

The story has never been told the public in a form vividly portraying the monumental contribution the electrical industry has made to modern civilization under the direction of men endowed with intelligence, initiative and vision. Too frequently the public reads and agrees with statements in popular magazines such as that recently made by William Lyon Phelps: "The electric light, with its enormous convenience, is not so good for reading purposes as the old kerosene lamp." Hundreds of equally erroneous statements appear in the public prints without contradiction and add to the mass of opinion-forming material which implants false impressions of the industry in the minds of the public.

In all history no parallel can be found to the development of the electrical industry in this country in a few short years to a degree that makes it a basis of habit, an essential to comfort and an ingredient in the achievement of success. This development is associated with numberless incidents susceptible of popular dramatization. Scientific inventions, commercial victories, human-interest stories, extraordinary financial developments are some of the stirring things that stand out. A new epoch of civilization has dawned, almost unnoted by the people of the world.

The story of the industry should be told with a glowing pen, for it is the story of an industry developed and built by private initiative which has benefited the world to a greater degree than any other commercial development in the annals of civilization. The history of electricity in this country proves the truth of the American conception of the proper way in which to insure industrial development. Were the story known it would compel public recognition and bring to the electrical industry and its leaders nation-wide praise.

A Disappointing Report

THE Giant Power Survey Board has rendered its report to the General Assembly of the Commonwealth of Pennsylvania. Its main findings in substance do not differ from those of the Coal Conservation Committee of Great Britain, made in 1917, and of a subsequent committee headed by Sir Archibald Williamson, resulting in the electricity bill of 1919. Strangely enough, America was the model held up before the Britons, and by following our methods of bulk production in superpower stations linked up and co-ordinated by main transmission lines it was hoped to treble and quadruple the per capita output of electricity in Great Britain, thus placing it on a parity with the United States.

In many respects the Giant Power report is disappointing. Sponsored by Gifford Pinchot and limited as it is to the Keystone State, much was expected of it; but the Superpower Survey made by the United States Geological Survey and involving the states along the Atlantic seaboard from Massachusetts to Virginia is an abler document. Problems with which engineers have wrestled for years without seeing light are accepted as solved, as, for example, by-product recovery from coal. Where and what the market would be for the coke, tar, oil and ammonium salts is not stated. Transmission lines would be common carriers, and separate ownership would be provided for generating, transmitting and distributing companies, involving, no doubt, three profits. Condensing water, in the estimation of

the board, is not so vital a factor as most engineers suppose. It would be a simple matter to operate a 300,000-kw. station with condensing water provided from cooling towers.

The newer generating stations in Pennsylvania are among the largest and most efficient in the world. Some are at the mouth of mines, others are at tidewater; but in every case they embody sound engineering. Every economy that can be effected is effected, because the very existence of electric light and power companies is predicated on their ability to generate electricity cheaper and better than any one else. The power station, however, is the smallest end of the business. Pennsylvania mines approximately 250,000,000 tons of coal a year, and of that amount the electric light and power companies burn only 5,000,000 tons a year, and in the main they burn it efficiently. The state stands second or third in the production of electricity, and if it were all produced on one-quarter of a pound of coal per kilowatt-hour—nay, more, if it were all produced for nothing—the saving in cost to the user would be very small indeed. This crucial fact the Giant Power Survey Board has apparently overlooked.

To Merchandise or Not to Merchandise? Face the Facts

THERE are still men in the electric light and power business who believe and argue that the central-station company should not go into the merchandising of domestic appliances. But the reason is that these men have not yet progressed sufficiently in their commercial thinking to see the matter rightly. For the trend toward merchandising is a sweeping movement in the industry with which eventually all men in executive control of electric service companies will line up because it is steadily becoming standard practice. There is a growing acceptance of the principle that the central-station company has a responsibility to the public to do its utmost to make electric comfort and convenience available right now to the American home and American industry.

Meanwhile, of course, there remain many small lighting companies and some larger ones where the old tradition holds that the public utility should not merchandise appliances. Among these companies, if one wishes, he can obtain any kind of an argument he wants against merchandising—negative objections, mostly based on the experience of organizations that are behind the times in their commercial policy. All of them overlook the fact that additional homes are coming on the lines faster than complete appliance equipment is being sold to them and that appliances will not be voluntarily purchased from retail shops on the initiative of the householder fast enough to keep up with this growth and complete the job of appliancing all connected homes. This means that the central station is obliged to play an active part in getting more appliances into the home. It must educate, stimulate and convince the public, helping the dealer at the same time better to fulfill his function by developing the local retailers to greater strength and usefulness.

The man who merchandises need not concern himself with the objections of the laggards. But it would be wise and well for the man who does not believe in merchandising to ask himself occasionally why he clings to this dwindling minority. His belief that his "conditions are different" is the weakest argument so far advanced.

The Economic Value of Centralized Engineering

FROM the New England telephone rate case at Boston have come to hand some interesting examples of the value of centralized engineering development and control, significant far beyond the confines of the specialized industry to which these are immediately applicable. The value of the services rendered by the staff organization of the American Telephone & Telegraph Company to the associated Bell companies has been under exhaustive inquiry during the past week, and the evidence as to these benefits in the field of engineering has been striking. It might be expected that the Bell staff organization would offer the most telling example of the economies and service benefits of engineering co-ordination that could be instanced in this country under present conditions of utility development, and yet few outside the telephone field sense their magnitude.

The engineers of the Bell interests testified that since 1912 improvements in cable sheath alloy have saved the Bell companies 8 per cent of their cable costs. The extension of the use of No. 24 gage wires from pole-type cable to smaller sizes of cables is saving these companies about a million dollars yearly, and it is estimated that if No. 10 gage cables had been used throughout the Bell system instead of No. 22 gage improved cables, the Bell system would have cost, including ducts, $90,000,000 more than at present. Developments in mechanically resistant braiding for so-called drop wires leading through trees to subscribers' buildings from outside terminals have resulted in the production of braiding to withstand twenty million rubs compared with twenty thousand rubs in former types, and the use of two conductors separately insulated under a common braid will save the companies $350,000 a year. Eighty million dollars has been saved the Bell system by the phantom circuit. On the New England system alone it is estimated that the use of audible ringing is saving $300,000 a year in operating labor and in fixed charges on switchboard equipment; that the substitution of machine ringing for manual ringing is saving an equal amount, and that the introduction of narrow-base keys allowing the number of trunks to be brought into a so-called "B" position to be increased from forty to forty-eight is saving $100,000 a year in Massachusetts alone. Research on operators' switchboard cords, including tests of twelve thousand different samples, resulted in the production of a type of cord saving an average of from one-half to one second per cord handling and in money economies closely approaching a million dollars a year.

These improvements represent a few of the tasks accomplished by the Bell centralized research and engineering organization in co-operation with the associated companies, and while their application is peculiarly adapted to the communication field, with direct service benefits to utilities among other telephone users, they indicate the importance of studying the problems of engineering co-ordination in all electric service systems facing or enjoying interconnection or centralized management. Granted that the day of a uniform system of electric light and power service comparable to the

country's telephone service is far distant, it none the less is desirable to study the possibilities of equipment co-ordination and the co-ordination of operating methods. To put it another way, the days of go-as-you-please design and operation are passing, and the vast possibilities of development in the production, transmission and distribution of electricity still to be realized should not blind engineers to the benefits of a reasonable degree of intersystem standardization. Co-ordination is equally interesting to the electrical manufacturing world, and finally to the ultimate consumer, in the interests of better and less expensive service.

Protect Electric Refrigeration from the Stock Jobber

THE broker has become conscious that the domestic electric refrigerator has a great future. The idea appeals strongly. Practically every home that uses electric light uses ice. Therefore it is logical to figure on a large proportion of the twelve million present customers of the light and power companies as prospective purchasers of refrigerators. Securities of electric refrigerator manufacturers are now selling on the curb markets of our financial centers. The public is interested in the new industrial development with its glittering promise. There is a danger in this situation, however, about which electrical men should feel concern. Only a few domestic electric refrigerating equipments have actually proved themselves. There are many others that are still in the development stage. The art is young and the average man is not yet able to discriminate when some silver-tongued stock salesman comes in and starts to sing his siren song.

In one recent case the representative of a brokerage house undertook to sell stock in a new refrigerator to a member of the N. E. L. A. committee on domestic refrigeration. He claimed that the machine would run for five cents a day, but he did not know what refrigerant it used or what type of thermostat or how many watts it would require. Another bond-house salesman recently asserted that eight cents a day would cover the expense and had a letter purporting to be from a man in the Bureau of Standards at Washington testifying to this. Another salesman offered stock in a machine to sell for $150 and said the president of his company wanted to sell it for $100, but he wouldn't let him—it wasn't necessary. Pressed for more data, he returned with an engineer-inventor who had interested a financier in the idea of an adaptation of a well-known machine. A pamphlet had been issued and stock selling started. In still another case a machine claiming the indorsement of a college laboratory was submitted to test when a stock sale seemed impending—and the motor ran continuously.

The fair name of the electric refrigerator must be protected. The public is ready to accept this new essential service to the home and to rejoice in it. It believes that the electric refrigerator has been perfected. But if enough of these stock-jobbing schemes are perpetrated and stories of resultant mechanical failures and financial disappointments become sufficiently notorious, it will be disastrous to the market. Every electrical man who is approached by fake promoters should accept a personal responsibility in exposing the attempted swindle and reporting it to the National Electric Light Association and the ELECTRICAL WORLD. A little prompt retribution will put a stop to the danger.

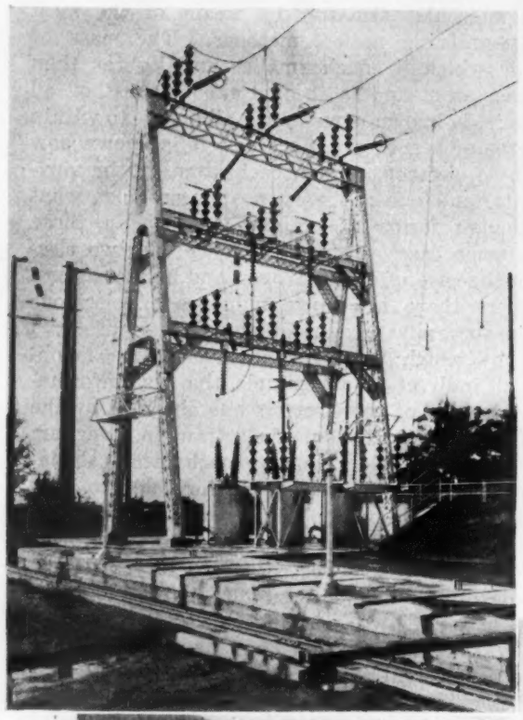
Seeing the Motion of Molecules

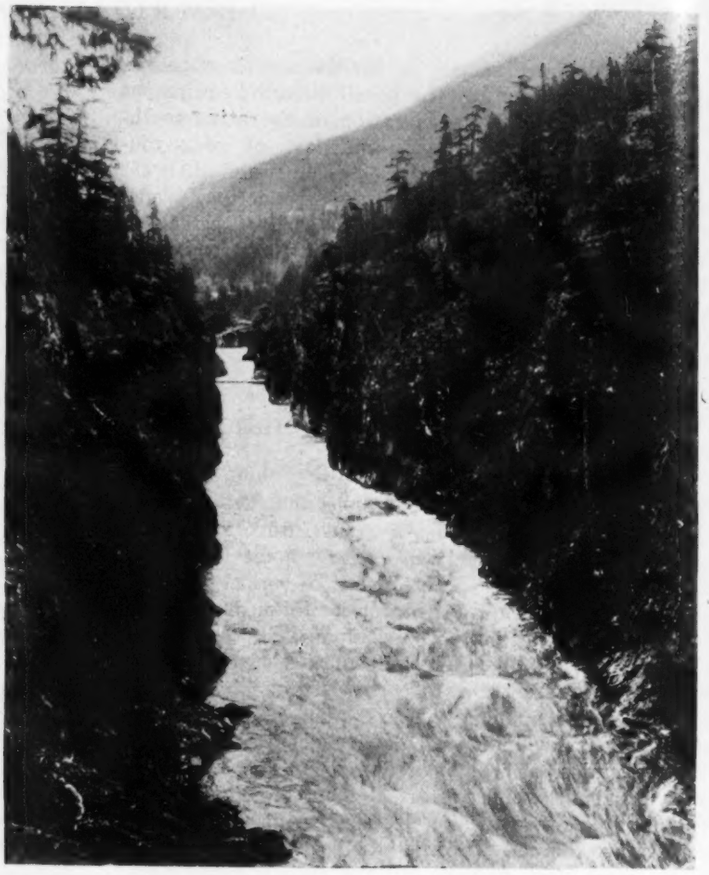
MANY people interested in physical science have difficulty in understanding the methods and means by which physicists are able to make definite statements as to such things as the size and mass of molecules, atoms and electrons and the enormous velocities and minute time intervals associated with their activities, when it is quite impossible to obtain the actual sight of a molecule of matter by means of the most powerful magnifying optical methods. The mass of the electron, which is much smaller and lighter than the hydrogen atom and is in fact the smallest of all known objects, is known now beyond all doubt, to within a high degree of accuracy. Moreover, it is known how many of these electrons are in each atom of the various elements, and one can very nearly say just what their particular forms of activity are within these atoms. In some cases there are only one or two electrons, as in the case of the hydrogen and helium atoms, and in others there are large numbers of electrons arranged in successive groups or rings.

Methods by which this type of information is obtained are all indirect. For example, the first information as to the mass of the electron was obtained by the bending of the cathode stream of electrons in a vacuum tube in a magnetic field. Purely mechanical calculations as to velocity and intensity of force led to definite conclusions in this case. The nearest approach to the actual sight of an electron is Millikan's experiment in which an electron attaches itself to an extremely small globule of oil, so small in fact that it floats in suspension between two parallel electrodes and can only be detected by a reflection from its surface of the light from a powerful electric arc. Other direct evidence to the senses has been found in the current leaving the positive plate in a hot cathode tube. Under proper conditions the "roar" of the shower of electrons falling on the plate has actually been heard in a telephone receiver, when the plate current is amplified.

Another recent instance of the bringing of molecules and atomic activities within the range of our perception is the discovery that under certain circumstances the magnetization of magnetic materials is not a continuous process but takes place in definite steps or jumps. This is known as the Barkhausen effect. A recent paper in the *Physical Review* by E. P. T. Tyndall describes further experiments in which the change in magnetic induction in a thin sample of silicon steel, as the magnetizing field increases, is investigated by means of a secondary coil in conjunction with an amplifier and oscillograph. It is clearly shown that as the field increases the magnetic injunction comes up by jumps or jerks. This indicates that the orientation of the magnetic molecule does not take place uniformly, but that it is affected by other properties of the material, causing the abrupt changes mentioned. The experiments in question aimed to determine the size of the particle that is involved in these discreet jumps in the magnetic induction, but no definite conclusion is reached on this point. The microphotographs of cross-sections of magnetic material show highly elaborate but irregular patterns. It is quite evident that these materials are anything but homogeneous in their ultimate structure. Under the circumstances it is not surprising to learn that magnetization is much easier along some paths than others and that if a specimen is sufficiently thin it is possible to detect the changes in magnetization along single paths or lines.

Skagit River Development of the City of Seattle





THE present Gorge Creek development of the city of Seattle provides 56,000 hp. at high water and 23,000 hp. at low water. Recently the city decided to issue for further extension bonds aggregating $15,000,000. If this plan is carried out, $8,000,000 will be expended in a development of the Skagit River at Ruby Creek which is expected to provide between 75,000 hp. and 80,000 hp. and $7,000,000 will be used in extensions of electric lines, purchase of five substations, etc.

The proposed Ruby installation will consist of a storage dam 330 ft. high and will be 9 miles above the present timber-crib dam at Gorge Creek. Recently the City Council named three Seattle engineers to make a survey of this proposed project.

Up to date the city of Seattle has expended approximately $13,000,000 on the Skagit hydro-electric development. The figures show that for actual construction a little over $11,000,000 was expended, the rest of the sum named representing charges incurred for bond interest and discount amortization.

The site of the proposed new dam and reservoir is directly beyond the section of Ruby Canyon shown directly above. At the bottom is shown the Gorge camp. The other illustration shows the Seattle end of the 105-mile, 160,000-volt transmission line from Skagit.

Modernizing Average-City Illumination

How Kalamazoo, Mich., Increased Street Illumination Two and One-Half Times and Still Reduced Load 45 per Cent, Besides Effecting Many Economies in Labor and Replacements—Installation Cost per Lamp $16

By EARL E. NORMAN
Superintendent Department of Public Utilities, Kalamazoo, Mich.

EARLY in 1922 it was realized that the street lighting system of Kalamazoo was inadequate. The equipment was not up to date and increasing traffic in the streets demanded that it be improved. It consisted of approximately 650 4-amp. magnetite-arc lamps, divided almost evenly among nine series circuits. Each circuit was fed by a mercury-arc rectifier with a capacity of seventy-five lamps. Not only was it realized that arc lamps were becoming obsolete, but they were objectionable because of the non-uniform light distribution produced, the excessive glare, the cost of trimming, the poor power factor and the energy consumption. To continue the same system of lighting and to allow for the next year's normal increase in the number of lamps installed would have made it necessary to install another rectifier and circuit. Better light distribution was desirable, maintenance had to be reduced, and conditions had to be changed so that the circuits could be utilized more effectively. Realizing the possibility of obtaining better results more economically by the use of incandescent lamps, a thorough study of the latter as applied to street lighting was made.

At the outset the writer was opposed to any glassware, whether diffusing or refracting, which would completely inclose the lamp, his observation having been that with any inclosing glassware bugs and dust would accumulate. The heat of the lamp would then bake a hard film of dirt and "bug juice" on the lamp, and this has proved as difficult to remove as paint or shellac. It was thought far better to leave the lower part of the lamp bare so as to prevent the accumulation of dead bugs. Although street dust would collect on the lamp, this can be easily wiped off when not baked on by "bug juice." Upon the urgent request of others, however, tests were made on various kinds of refractors, including those of the closed-bowl design.

Illumination Measured on Vertical Plane

Up to this time the standard method of making distribution curves consisted of measuring the illumination in foot-candles on the horizontal street surface. This method is probably a fair one to use as a universal standard in comparing various methods of illumination, but, in the writer's opinion, it does not show the true value of street illumination. The driver of an approaching car is not so much interested in seeing the street surface as the obstructions in the street, the most important of which are human beings. The most easily discernible part of a pedestrian, when he is in the street, is probably the shoulders and head, which on an average are 4½ ft. or 5 ft. above the pavement. The illumination necessary to disclose a pedestrian is not the illumination on a horizontal surface nor exactly the illumination on a vertical surface. In the lighting tests in Kalamazoo it was therefore considered that the illumination striking a surface inclined 15 deg. from vertical and 5 ft. from the ground would be the best measure of the value of street lighting.

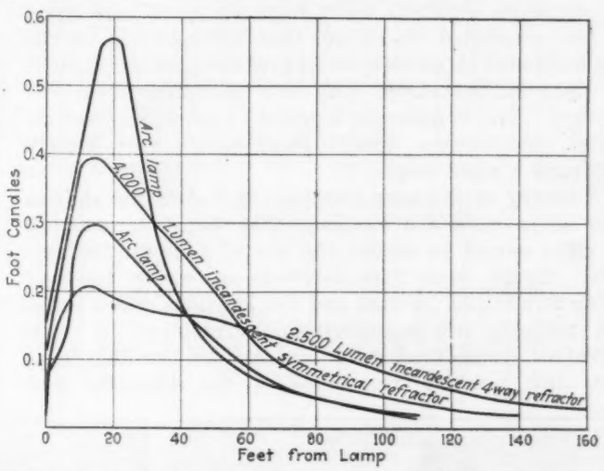


FIG. 1—ILLUMINATION PRODUCED ON SURFACE 15 DEG. FROM VERTICAL AND 5 FT. FROM GROUND, USING REFRACTORS

Various refractors were obtained and distribution curves were taken showing the illumination in foot-candles 5 ft. above the street on a surface 15 deg. from the vertical. A set of these curves is shown in Fig. 1. Two of the curves shown there were taken at random from two arc lamps—one curve with a 4,000-lumen lamp in a symmetrical-bowl refractor and one with a 2,500-lumen lamp in an asymmetrical four-way refractor. It may be observed from these curves that while the 2,500-lumen lamp in the four-way refractor gives an intensity of about half as much as the arc lamp within a radius of about 30 ft. from the lamp, it exceeds the arc lamp in illuminating value at a distance of 45 ft. or more from the light source. This confirms approximately the distribution curves furnished by the manu-

COST OF INSTALLING KALAMAZOO LIGHTING SYSTEM

	Labor			Material			Total
	Hours	Cost	Unit Cost	Cost	Unit Cost	Total	Unit Cost
First circuit of 140 lamps	427	$259.95	$1.86	$1,754.97	$12.53	$2,014.92	$14.39
Remaining circuits, 583 amps.	2,534	1,870.51	3.21	8,198.76	14.06	10,069.27	17.27
Ladder truck	488½	367.39	367.39	749.05	749.05	1,116.44	1,116.44
Totals	3,449½	$2,497.85	.....	$10,702.78	.....	$13,200.63	.....
Credit by sale of material	.....	.....	.....	1,600.00	.....	.....	.....
Net total cost, 723 lamps	3,449½	$2,497.85	$3.45	$9,102.78	$12.59	$11,600.63	$16.04

facturers respectively of the arc lamps and the four-way refractors. These distribution curves are shown in Fig. 2, together with the curve of a 4,000-lumen lamp in a symmetrical bowl refractor. It was even found by experiment that a four-way refractor using a 1,000-lumen lamp gave a greater intensity than the arc lamp at a distance of 80 ft. or more from the source.

By reference to Fig. 1 it may be seen that a 2,500-lumen lamp in a four-way refractor gives about twice

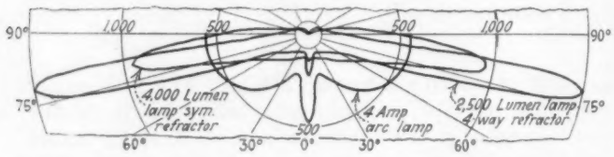


FIG. 2—FLUX DISTRIBUTION IN VERTICAL PLANE FROM ARC AND INCANDESCENT LAMPS IN REFRACTORS

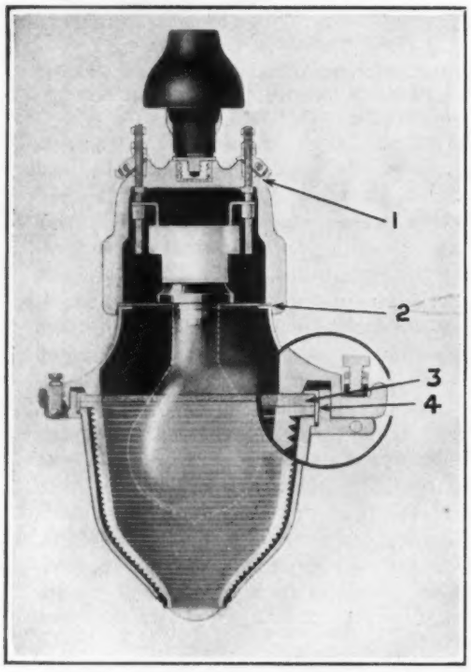
the intensity of the arc lamp at a distance of 70 ft. or more from the light source and requires only 162 watts as compared with 310 watts required by the arc lamp. It was concluded, therefore, that the adoption of the asymmetrical refractors would give the greatest amount of light on the street with the least expenditure of energy. These fixtures, however, cannot be used at street intersections except those which very closely approach a right angle.

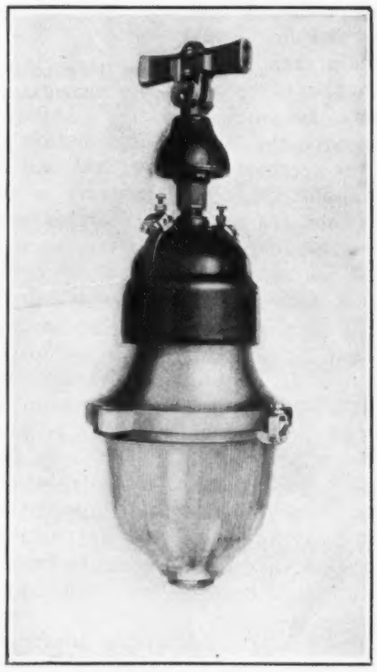
A survey of the lamp locations in Kalamazoo showed that there were 475 locations that were near enough to right angles to permit the use of four-way refractors. There were fifty locations at which two-way refractors should be used and 198 locations which could not properly use asymmetrical refractors. It was, therefore, considered good economy to use the four-way and two-way refractors at the 475-lamp and fifty-lamp locations respectively, using 2,500-lumen lamps in them. Symmetrical-bowl refractors with 4,000-lumen lamps could be used at the 198 locations where asymmetrical refractors should not be used.

HYDRAULIC TEST FOR DUST TIGHTNESS

The writer was still not converted to the use of inclosing glass around the lamp. Consequently various fixture manufacturers were asked whether they could provide dust-tight and bug-proof fixtures. All replied in the affirmative, but after operating 140 fixtures of the three leading types for approximately one year, it was found that none of them came up to specifications regarding being dust-tight and bug-proof. Then the manufacturers were asked to redesign their fixtures to meet specifications. When they again submitted their products, it was hard to determine which would offer greatest resistance to the accumulation of bugs and dust.

It being then the fall of the year, satisfactory service tests could not be conducted by hanging the fixtures in the street to observe the accumulation of dust and bugs; neither could an artificial method of producing clouds of dust be devised which would duplicate street conditions. The idea was then conceived that if the fixtures offered a reasonable resistance to leakage of water, this would be a measure of their resistance to "leakage" and dust. While all the fixtures leaked when filled with water, the type offered by the Line Material Company showed promise, since felt gaskets could be applied between the refractor and fixture body, between the body and insulator and around the terminals to eliminate leakage. Gaskets were, therefore, inserted. When thus modified the fixture proved to be water-tight. An order was therefore placed with the Line Material Company for its water-tight fixture (which





FIGS. 3 AND 4—DUST-PROOF AND BUG-TIGHT LIGHTING FIXTURE ADOPTED

Gaskets may be observed around the terminals at 1 (Fig. 3), between the insulator and fixture body at 2, and between the fixture body and the refractor at 3. At 4 is indicated an L-section brass ring which is used to secure the felt gasket to the refractor, the ring being clamped by screws to the refractor holder indicated by 1 of Fig. 3. The socket is supported by two long studs which project through the main fixture insulator. These also carry the current to the lamp. By turning these studs,

FIG. 5—OLD ARC-LAMP MAST ARM UTILIZED FOR NEW FIXTURES

by the nut at the uppermost end, the socket can be raised or lowered, thereby bringing the lamp into proper focus in the refractor. The socket in the fixture is a standard series socket in which is used a General Electric cartridge film series cut-out.

is an adaptation of its "Tite-Light" fixture). The accepted fixture is shown in the accompanying cross-section (Fig. 3).

Maximum Rating in Inclosed Bowl

When it was first suggested to inclose "Mazda C" lamps completely and shut off all ventilation, the question arose as to whether this would have a detrimental effect on the operation of the lamps so inclosed. The fixture manufacturers did not agree in their decisions. Upon inquiry directly from the lamp manufacturers, however, it was reported that the present-day "Mazda C" lamp is not affected in any way by any temperature below the melting point of the glass. However, the manufacturer of the fixtures purchased recommended the tight fixtures (of the straight series type) only with lamps not over the 4,000-lumen size. He claims that although there will be no damage done to the lamp or fixture if a larger lamp is used, the temperature inside the fixture will be so high as to char the film cut-out. This contention has been borne out in operation of the fixtures during the past ten months. The film cut-outs sometimes become slightly brown owing to high temperature, but do not give any trouble. It is very evident, therefore, that a larger lamp could not be used in a tight fixture with a film cut-out. If a larger lamp were used, it would unquestionably be more economical to use a 15-amp. or 20-amp. lamp and an individual transformer or auto-transformer which could be placed outside the fixture and would make the use of a film cut-out unnecessary. No trouble with refractors breaking because of the high temperature has been experienced. This is believed to be because the refractors are not clamped between metallic surfaces but against a soft felt gasket.

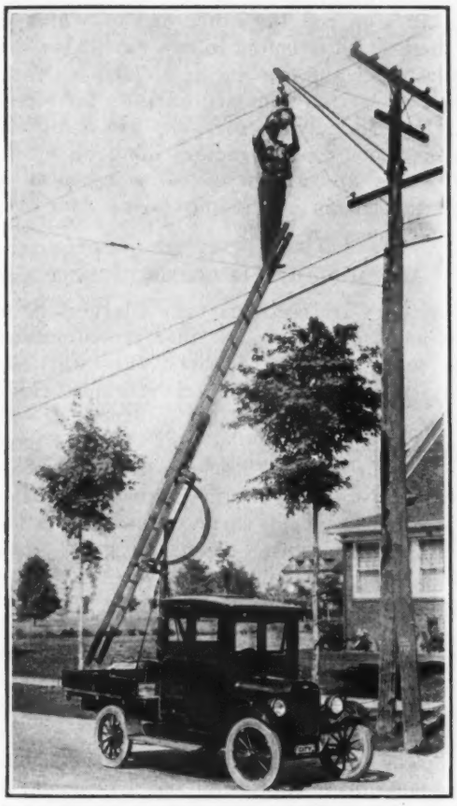
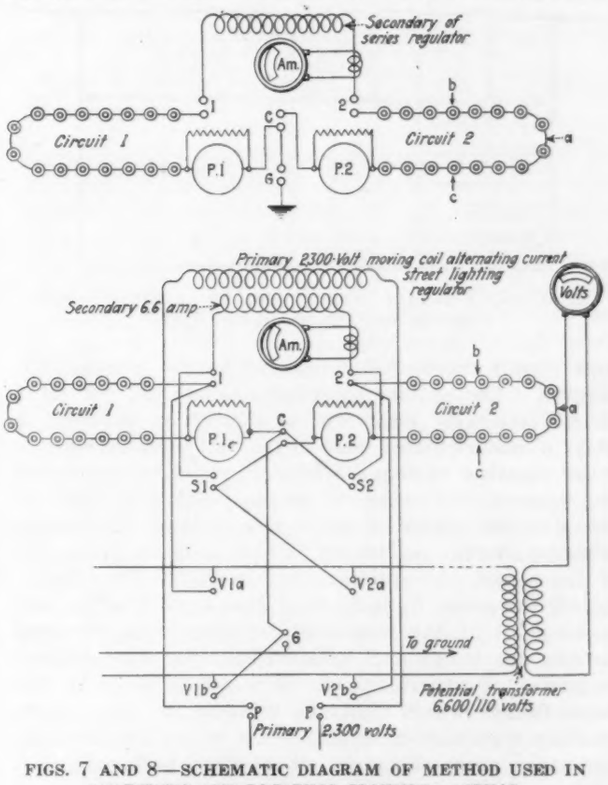


FIG. 6—SPECIAL TRUCK TO FACILITATE MAINTAINING LAMPS WITHOUT LOWERING

So as to make it safe for a man to handle live fixtures, the ladder is insulated from the truck by 6,600-volt insulators. The ladder can be swung completely around the horizontal circle, either to the right or the left. It is locked in the desired position by a handle, which turns a set screw into a recess in the vertical shaft. The latter can be tipped upward from the horizontal and held in any desired position by a pin which passes through holes in semi-circular pieces, which turn with the ladder, and into a hole in a collar around the shaft, which remains stationary. The ladder itself may be extended as any extension ladder.

Maintaining Fixture in Place

The use of the asymmetrical refractor precluded the use of any form of suspension which allowed the fixture to swing free and orient itself at any angle with the street. Furthermore, the letting of fixtures down to the street for maintaining them has always proved more or less unsatisfactory. Either the cut-outs or slack loops, as the case may be, give considerable trouble. Therefore the possibility of fastening the fixture rigidly on the support without providing means of lowering it to the ground was considered. To permit the maintenance of the lamps a special truck shown in the accompanying illustration (Fig. 6) was developed. The total cost of the "ladder truck" was $1,116.44, which includes the cost of the chassis, ladder, machine work, labor, body and all development charges. The truck was put in service during January, 1924, and has now been in use eleven months. Its use has been highly satisfactory in every way. Even if its use had



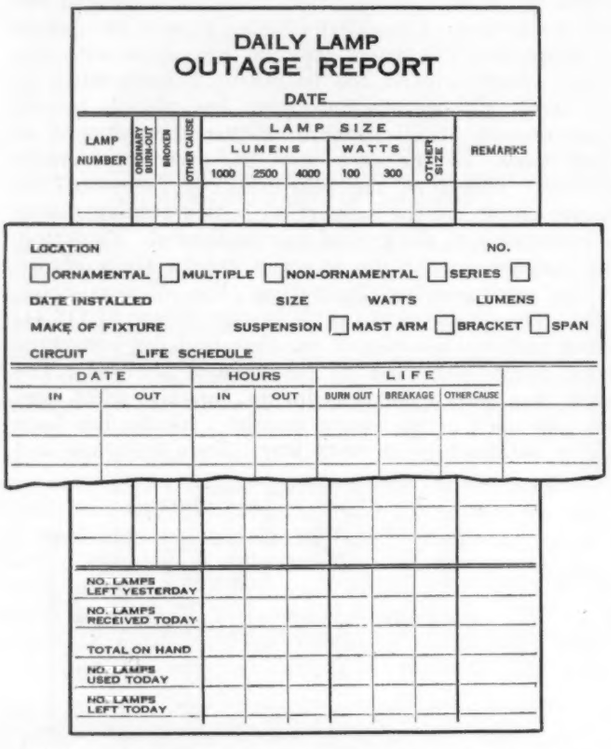
FIGS. 7 AND 8—SCHEMATIC DIAGRAM OF METHOD USED IN DETECTING AND LOCATING GROUNDS; ACTUAL WIRING OF SERIES PANEL

By plugging in *G* a ground is placed at the common connection between the circuits. *P1* and *P2* are pilot lights of the two respective circuits, mounted on the switchboard. The lamps used are standard 1,000-lumen, 6.6-amp. series lamps, shunted by a resistor so that they just glow. (The resistors were salvaged from the old rectifiers.) *Am* is an ammeter indicating the current in the series circuit. If all four plugs are in and no ground exists on the external series circuits, both circuits will operate properly. If a ground occurs at *c*, however, the lamps between this point and the ground plug *G*, including pilot light *P2*, will be shorted out by the current's passing through ground *c* and *G*. This will at once be detected by the plant operator because of extinguishment of pilot light *P2*. Service may then be restored by removing the ground at *c*, or the plug *G* may be removed temporarily, thus restoring service until the ground at *c* is located.

not been a necessity on account of using asymmetrical refractors, it has been more satisfactory than the use of either cut-outs or slack loops and letting the lamps down to the street.

OLD LAMP SUPPORTS UTILIZED

No attempt was made in Kalamazoo to lay out a completely new lighting system. Lamp locations and spacings have not been changed. The old arc lamps


DAILY LAMP
OUTAGE REPORT

DATE

LAMP NUMBER	ORDINARY BURNOUT	BROKEN	OTHER CAUSE	LAMP SIZE: LUMENS 1000	LUMENS 2500	LUMENS 4000	WATTS 100	WATTS 300	OTHER SIZE	REMARKS

LOCATION NO.

☐ ORNAMENTAL ☐ MULTIPLE ☐ NON-ORNAMENTAL ☐ SERIES ☐

DATE INSTALLED SIZE WATTS LUMENS

MAKE OF FIXTURE SUSPENSION ☐ MAST ARM ☐ BRACKET ☐ SPAN

CIRCUIT LIFE SCHEDULE

DATE IN	DATE OUT	HOURS IN	HOURS OUT	LIFE: BURN OUT	BREAKAGE	OTHER CAUSE	

NO. LAMPS LEFT YESTERDAY								
NO. LAMPS RECEIVED TODAY								
TOTAL ON HAND								
NO. LAMPS USED TODAY								
NO. LAMPS LEFT TODAY								

FIG. 9—DAILY OUTAGE REPORT. FIG. 10 (INSERT)—CARD RECORD FOR KEEPING LAMP LIFE

were simply removed and replaced by the incandescent fixtures. The system therefore is not laid out on a strictly scientific basis but is merely an attempt to adapt a modern street lamp in the best possible manner to an existing system. While it was recognized that the four-way refractor, to be most effective, must be placed in the center of street intersections, the fixture adjusted so that the beams will shine down the center of the street, the appropriation available for rehabilitating the street lighting in Kalamazoo did not permit junking all of the mast-arm supports formerly used for the arc lamps and substituting span-wire or post supports. Furthermore, it is questionable with the dense foliage which exists on most of the city streets whether span-wire mounting could be used to the best advantage since the units would have to be mounted too low. As it is, with the mast-arm supports extending over the street about 8 ft. to 10 ft., the lamps could not be mounted much higher than 22 ft. to 24 ft. on account of the foliage.

Fortunately, the mast arms were of such design that any fixture hanger designed to be hung on a span wire could be attached to the mast arms without making any change in them. Consequently a clamp-type hanger was adopted by which the fixture could be attached to either mast arm or span wire. The fixture, clamp hanger and end of mast arm and the method of assembly are shown in Fig. 5. As shown, the mast arm consists of two parallel pipes about 4 in. between centers, joined at one end by a "U" fitting and attached at the other end to a casting which fits around the pole and to which they may be fastened by a through bolt and two lag screws. A tension rod fastened to the pole some distance above the attachment of the mast arm runs through a slot at the outer end of the mast arm and terminates in an eye. Through this eye runs an iron rod the other end of which is bent at right angles and is bolted to two flat plates spanning the parallel pipes and serving as a clamp. On this rod is attached one of the standard hangers for street-lamp fixtures. Surprisingly good results are being obtained with the asymmetrical refractors hung on mast arms, although these are gradually being replaced by the span-wire suspension as the mast arms wear out. The longest mast arms are 14 ft.

ADAPTING OLD SERVICE EQUIPMENT

Since mercury-arc rectifiers take a large lagging current, the windings of the rectifier transformers must be made large enough to carry this wattless load. Therefore, the windings of the transformers are capable of carrying kilovolt-amperes far in excess of the rated output of the outfit in kilowatts. In this particular case the output of the seventy-five-light, two-tube, 4-amp. mercury-rectifier outfits already installed was 27 kw. each. To adapt them to new conditions the rectifiers, reactors, static discharge gaps, etc., were removed. New secondary coils were substituted on the transformers for the old, changing them to alternating constant-current 6.6-amp. series regulators. Since the power factor for a circuit for incandescent lamps is practically unity, the full kva. capacity of the transformers could now be used as kw. capacity; thus their output was increased from 27 kw. to 40 kw. at unity power factor. By substituting the 2,500-lumen and the 4,000-lumen lamps for the arc lamps, as outlined above, the load was reduced from 236 kw. to 130 kw., or a reduction of 45 per cent despite the 250 per cent increase in street-lighting intensity.

With such a reduction in load it was not necessary to use all the nine rectifiers installed. It would have been possible to change the nine circuits to four circuits, feeding them with four rectifiers converted into alternating-current series regulators. However, it was considered that this would make the circuits so large as to be unwieldy. In case of trouble it would necessitate the darkening of one-fourth of the city to cut off a circuit. Consequently, it was decided to convert four of the rectifiers to alternating-current series regulators and to rewire the switchboard panels so as to feed two circuits from each regulator. The maximum voltage required on any pair of circuits in series is 7,500. No advantage is seen in cutting down the number of lamps per circuit with the facilities which the revised switchboard provides for detecting and locating outages and isolating faulty sections of the circuit.

METHODS OF CHANGING OVER

The installation of the system was made in the winter time when little other work could be done. Two gangs of two men each (if two men may be called a gang) were used on this work. On account of the old circuits operating at 4-amp. direct current and the new circuits operating at 6.6-amp. alternating current, proper co-ordination of the exterior work and interior

work was necessary. The two gangs would start a circuit at opposite ends thereof. A 6.6-amp. lamp operating at 4 amp. little more than glows. In order to compromise the condition of having 6.6-amp. incandescent lamps and 4-amp. arc lamps in the circuit at the same time, the adjustment of the rectifiers in the plant was changed so that a current of approximately 5 amp. was held on the series circuits. Although this gave a very poor light on the incandescents for a few days (while the circuit was being changed over), still it made the change-over possible without too much complaint from the citizens. When the circuit was within two days of being completed, the rectifier in the plant was changed to a 6.6-amp. alternating-current regulator, and the circuit was then operated at about 6-amp. until all arc lamps were removed from the circuit being reconstructed.

To facilitate keeping record of the lamps, each lamp is numbered. The numbers in the original circuits were determined by arranging all of the lamps of the system in alphabetical order (by streets), then numbering the lamps thereon consecutively. Future extensions are made by placing the lamp in the proper place in the alphabetical list and using a number for the new lamp which is a decimal of the next lamp adjacent thereto; thus the lamps are always in both numerical and alphabetical order. The number of each lamp is also stenciled on the pole supporting the lamp.

Record is kept of the life of each and every lamp. The chief engineer of the power house is required to keep a record of the total cumulative hours each circuit is in operation. This record he shows on his daily report. The difference in the cumulative hours of any circuit between any two dates will give the number of hours that particular circuit was in operation between these two dates. When a lamp is replaced the troubleman makes a report on the form shown in Fig. 10. This report was made as simple as possible so as to encourage the troubleman to make it complete. It is usually only necessary to record the lamp number and make two check marks in reporting an outage—one indicating the cause of the renewal and the other the size of the lamp.

A card index is provided in which the lamps are arranged in both alphabetical and numerical order as described above. The form used for this record is shown in Fig. 10. The information on the outage report (Fig. 9) is posted to the proper life card, thus showing the date the lamp is placed in service, the date removed from service and the cumulative hours on those corresponding dates. The difference in the cumulative hours is recorded under "Burn-out," "Breakage" or "Other Cause" as the case may be, and this difference shows the total life of that particular lamp. Westinghouse "Mazda" lamps are used at present.

Some Advantages and Some Marked Economies

The system has been very satisfactory. The dust-proof and bug-proof fixture has proved especially valuable, making it unnecessary to clean the glassware except as lamps are replaced. The lighting units have been adjusted in focus so as to give a very even distribution of light. In fact, when one is standing and looking down on the street, shading the eyes so that the sources of light cannot be seen, the light distribution is so even that it is difficult to determine just where the lamps are. The average intensity of light on the street surface has been increased two and one-half times, while the load has been reduced 45 per cent. Owing to the asymmetrical light distribution, the light projected against buildings on the street corners has been reduced to less than one-third of the intensity of the light formerly so projected by the arc lamp. This has reduced complaints about bright lights shining into windows of adjacent and nearby houses on the street corners.

Besides reducing the light against the houses on the street corners to one-third, increasing it on the street surface two and one-half times and reducing the total

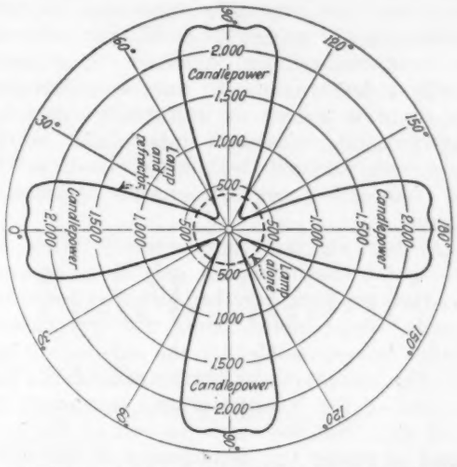


FIG. 11—LATERAL FLUX DISTRIBUTION OF FOUR-WAY REFRACTOR IN CONE 10 DEG. BELOW HORIZONTAL

Based on 4,000-lumen "Mazda C" lamp; with 2,500-lumen lamp used intensities would be approximately twenty-five-fortieths of values shown.

series lighting load 45 per cent, labor costs have also been materially reduced. Two full-time and one part-time man were formerly necessary to maintain the arc lamps. The services of the part-time man and one full-time man have been dispensed with, netting a saving of $2,500 per year. The cost of electrodes, globes, arc-lamp repairs, etc., amounted to $3,000 a year, whereas the cost of incandescent renewals and repairs to fixtures now amounts to $2,500, showing a saving of $500 per year. The net savings per year are: Coal (by reduced load), $4,000; labor, $2,500; repairs, $500, or a total net saving of $7,000.

The complete cost of installing this system is shown in the table. By it a net saving of $7,000 per year is shown to have been realized on an investment of $11,600.63, giving a return on the investment of 60 per cent.

Besides the savings in operating expenses, there is an annual saving of capital layout due to the reduced cost of new construction. The new lamps cost $40 each less to install than arc lamps. On a program of twenty-five new lamps per year this amounts to $900 less capital outlay. These figures do not take into consideration the improved lighting obtained, but when one considers the foregoing financial savings and then realizes that the light on the streets has been increased two and one-half times, the value of the new lighting system is appreciated. Furthermore, the four alternating-current regulators of the new system are loaded only to 81 per cent full load, whereas the nine rectifiers of the old system were loaded to 97 per cent full load. To continue the old system would also have required an expenditure of $3,500 for the installation of a new rectifier and circuit of arc lamps.

Advantages of Uniform Ordinance

Confusion from Free Establishment of Local Codes —Need for Uniformity Based on National Codes—Manufacturers Take Action

BY T. E. BARNUM*

THE manufacturers of electrical equipment and materials are primarily interested in uniformity and generally are willing to build apparatus according to the recognized national standard. They are also not only willing but anxious to have that standard high. Where there is a lack of uniformity—that is, where requirements in cities and states differ markedly—it becomes very difficult to market their product and almost impossible to give proper service to the consumer.

In the last analysis the necessary thing is proper service to the consumer, not only as to the quality of the product, but as to whether or not it conforms to the local code requirements, since the purchaser of the apparatus is responsible for the safe condition of his plant. The manufacturer is only secondarily interested in the cost of the installation and equipment from the point of view that the excessive cost of the installation will tend to retard the development of the use of electricity for its various purposes of lighting, heating and power. Excessive cost of the installation tends to affect the whole industry—not only the manufacturer, the jobber and the contractor, but the user as well.

In recent times there has been a very great activity on the part of cities and states in the preparation and adoption of electrical codes. In each city there are local conditions, and local practice usually varies. It is therefore quite natural that a city should require by law what previously had been considered best practice in that city. Then, too, the local code was being written by a group of local men who had their own ideas of the present and future development of the art and necessarily incorporated their ideas in the local ordinance. This has resulted not only in having the local codes differ greatly from the national code, but in the introduction into the local code of some unnecessarily severe restrictions. The pressure of this situation has emphasized the necessity of getting a greater uniformity in the code requirements in different localities.

One method was to work with the group of local men interested in writing a new ordinance and attempt to persuade them to adopt the national code without change as far as possible, to check the introduction of unnecessarily severe restrictions, and, generally, to obtain as great a uniformity in the code requirements as possible. In carrying out this work local prejudices were encountered, and a number of conflicting interests were also developed. Experience with this work indicated that it was not a practical solution of the difficulty, and over a period of some time the practical results were about nil.

About that time in one state a "uniform ordinance" was developed and proposed to the cities in that state, in an effort to avoid the confusion of conflicting requirements between the state code and the local codes. This idea of a uniform ordinance seemed to offer a practical solution for many of the existing difficulties and such an ordinance, which can be used anywhere, has been developed. This ordinance, in general, makes it possible for a city legally to make the national standards as developed under the American Engineering Standards Committee's procedure (now established for the guidance of the National Electrical Code and the National Electrical Safety Council) the standards of the city for fire and safety construction, without actually writing those codes in the ordinance. It is readily seen that if the local ordinance is so drawn as to make the national codes the standards of the city or state, the local code is always up to date, since it is automatically revised as the National Code is revised. It is also clear that this situation is possible only where the code is in no sense a proprietary code, but is a truly national standard. It is hoped and believed that the standards developed under the procedure of the American Engineering Standards Committee will be truly national standards and as such have such a standing that they will be accepted by the city and city authorities. Only by having such a standard can they be accepted generally as the standard of the nation and be used universally.

Another expedient which is being tried is to utilize the doctrine of equivalents and to attempt to get the city to write into its ordinance a clause which makes lawful in that city what advanced good practice considers to be the equivalent as regards fire and casualty hazard of the construction specifically required by the law. Under the old method of the local code and the national code the tendency was to extreme conservatism, with the result that it was virtually impossible for a manufacturer to place upon the market any new materials or devices. The old procedure was thus a definite bar to progress in the art.

NATIONAL CODE THE BASIS

The national codes have been placed under the procedure of the American Engineering Standards Committee since it is quite essential to the industry that the national codes must have a proper standing, not only in the courts but in the opinion of the general public. Another essential in this program is that the revisions of the national code must be frequent, at least sufficiently frequent for the code to keep pace with the development of the art. In promoting this idea it is hoped that each city in developing new ideas will report them to the sectional committee having the code in charge and thus give the committee a chance to put the new ideas into the national code, instead of having the city put such new ideas only into the local code. While development of the art is due very largely to the manufacturers and those in charge of the installation work, practical experience in the administration and enforcement of the codes frequently develops very valuable ideas, which should be incorporated into the code as soon as possible. Such ideas, however, generally need a thorough discussion by those best posted throughout the country so as to get a national view of the situation rather than a local decision.

Different branches of the industry are working together to promote actively the idea of general recognition of the national codes, and particularly through the general use of the uniform electrical ordinance which

*Chief engineer Cutler-Hammer Manufacturing Company, chairman casualty and fire prevention committee, Electrical Manufacturers' Council.

has been developed through the work of the law committee of the Electrical Manufacturers' Council. At the present time one large city is developing its new ordinance along the lines of the council's uniform ordinance; that is, it is proposing to adopt the short ordinance which, among other things, makes the national codes for fire and safety the standards of the city. This will be a very important event in the development of regulatory legislation.

To summarize very briefly the uniform electrical ordinance:

1. Creates the office of electrical inspector and specifies his qualifications, duties, limitations and a method for his appointment and removal.

2. Requires the regular inspection of the installation in buildings of wiring devices and materials.

3. Gives the electrical inspector authority to order changes and repairs and under certain conditions to order the discontinuance of electrical service and gives him the right of access to buildings to make inspections and tests.

4. Provides for a system of permits for the installation or changing of electrical equipment and for certificates of inspection and records.

5. Requires that all electrical installations shall conform to the most approved methods of construction for safety to life and property and makes the regulations of the National Electrical Code and the National Electrical Safety Code, as approved by the American Engineering Standards Committee, prima facie evidence of such most approved methods.

6. Provides for an appeal from the decision of the inspector, for penalties and for enforcement.

7. The ordinance has two optional sections, one of which suggests the basis for clauses in the ordinance for fees for inspection; the other section suggests a basis for clauses for the licensing of persons, firms or corporations as master electricians.

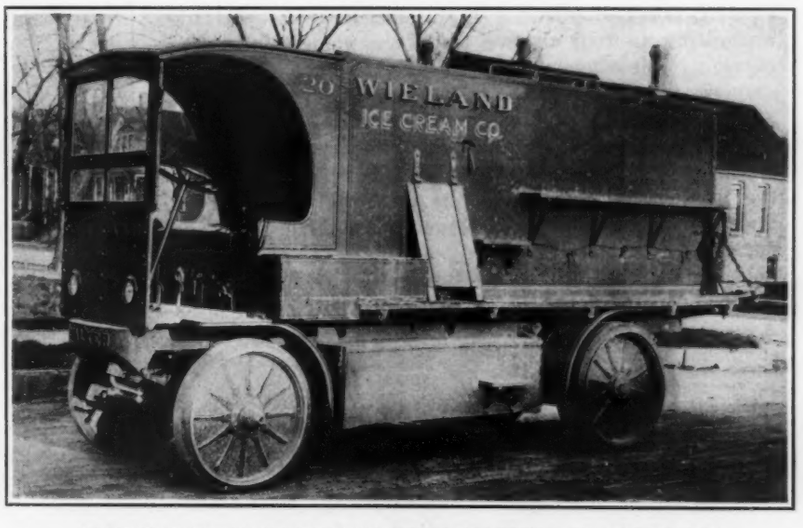
Features of Electric Truck Motors

Discussion of Speed and Torque Characteristics—Effect of Efficiency Values and Rating on Performance—Comparison of Motor Designs—Seven Important Mechanical Requirements

By C. A. ATWELL

Motor Engineering Department, Westinghouse Electric & Manufacturing Company

THE general speed-torque characteristic of the series-wound motor has the same suitability for propelling the electric truck that has caused it to become standard for other forms of electric traction, such as street cars and locomotives. The series type of motor supplies high torque at standstill or low speed, when it is required for acceleration, and lighter torques at higher speed after the vehicle is under way. This kind of speed-torque characteristic is ideal from the standpoint both of starting and of continuous running.



MODERN ELECTRIC TRUCKS HAVE DEFINITE FIELDS OF APPLICATION IN SHORT-HAUL, FREQUENT-STOP SERVICE

The speed and torque relation of the series motor is the most favorable for conserving electrical energy over a route which requires frequent starts. This is most easily understood by recognizing that the power which must be supplied by the motor is always proportional to the speed multiplied by the torque. If the characteristics were such that the speed were always in inverse proportion to the torque, then the power required of the motor would be a constant. This, of course, is impossible owing to the magnetic saturation that exists in the series motor. Such a relation is not necessary as it is not important that the power drawn from the battery be constant, but that it be kept from being excessive. This is because the battery input-output efficiency is less for high rates of discharge.

It has been found by comparative tests, and also by speed-time curves calculated for a given truck and route, that of the motors otherwise equal the one with the steeper speed curve will propel the vehicle more miles per charge. This comparison is usually made roughly by comparing the "torque ratio" of the two motors. Torque ratio is defined as the ratio of motor torque at two and one-half times the continuous rated amperes to that at the continuous amperes. A more accurate comparison can be made, provided a typical truck route is known, by drawing two sets of speed-time curves using the performance curves of the two motors in question. A comparison of the total ampere-hours required by each motor will indicate which motor will produce the maximum miles per battery charge.

Fig. 1 shows the speed and torque curves for two

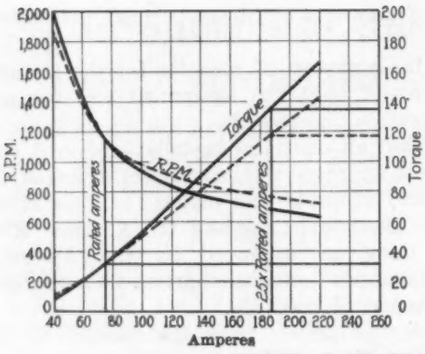


Fig. 1—Speed and torque curves for two motors having the same speed rating but different torque ratios (80 volts, 75 amp., 1,150 r.p.m.).

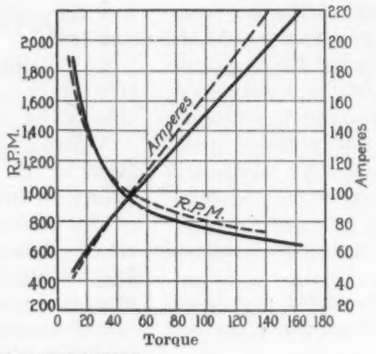


Fig. 2—Curves of Fig. 1 replotted to show variations of speed and current with torque for two motors having the same rating but different torques.

EFFECT OF TORQUE CHARACTERISTICS

different motors which have the same speed at continuous rated current but which have different torque ratios. The full lines represent the performance of a motor with a torque ratio of 4.1 to 1, while the dotted curves show a torque ratio of 3.6 to 1. It is often convenient to replot the curves shown in Fig. 1 in the form shown in Fig. 2. When plotted in this form it is easy to see the comparative current and speed at the same torque.

EFFECT OF EFFICIENCY

The efficiency of the electric truck motor is as important a factor as is the shape of the speed-torque curve in conserving battery energy and producing the maximum miles per charge. The frequent starting of the electric truck requires a high efficiency at overloads amounting to four or five times the continuous rated current. The efficiency at loads less than the continuous amperes is relatively unimportant as the motor operates at these loads only a very small percentage of the time. During overload conditions the motor losses consist mainly of I^2R losses in armature and field coils and in the brushes. For this reason these parts should be liberally proportioned. This is accomplished in the design of the motor by using large-size armature and field conductors of rectangular section and by applying a sufficient number of brushes of low contact drop. A motor which has a large proportion of copper as compared with the iron of the magnetic circuit is often called a "copper" motor. The electric truck motor might be rightly called a "copper and carbon brush motor." Figs. 3 and 4 show the performance curves of motors which are typical for use on street trucks and factory trucks. These curves are extended out to five times the continuous amperes in order to show the efficiency at overloads.

MOTOR RATING

The conventional rating of electric truck motors is stated in volts and amperes input and revolutions per minute. When run continuously on stand with covers in place, the temperature rise of the windings must not exceed 65 deg. C. above the air temperature when measured by thermometer, or 80 deg. when measured by the resistance method. It should be remembered that this method of rating is an arbitrary one and represents a condition which is rarely, if ever, met by the motor in service. In typical service the motor encounters a series of overloads, medium loads, coasting periods and idle periods, while the continuous temperature test gives a condition of light load and constant high speed. For this reason similar motors should not be compared on the basis of continuous rating alone, but the torque ratio and overload efficiency should also be considered.

It may even be the case that of two similar motors

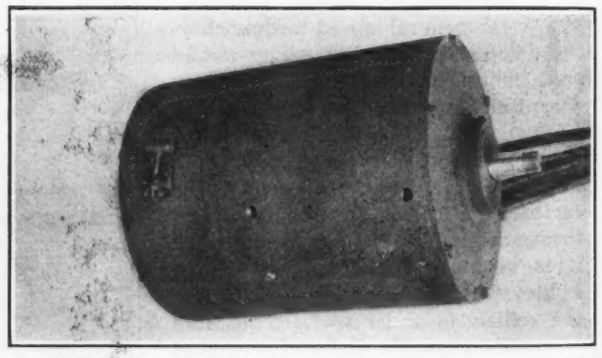


FIG. 6—A TYPICAL TRUCK MOTOR

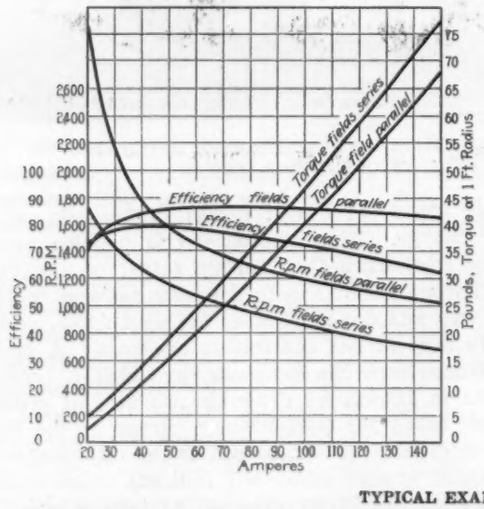


Fig. 3—Characteristics of an 80-volt, 30-amp., 2,150-r.p.m. motor used on light delivery trucks.

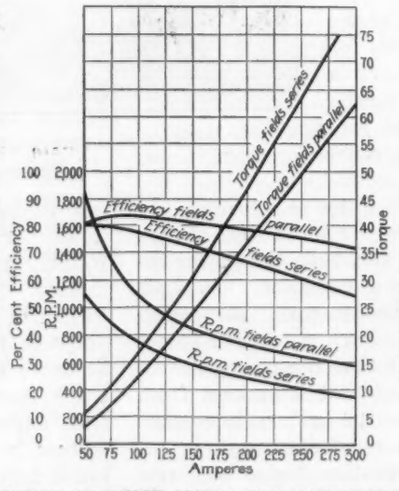


Fig. 4—Characteristics of a 24-volt, 60-amp., 1,650-r.p.m. motor used on factory trucks.

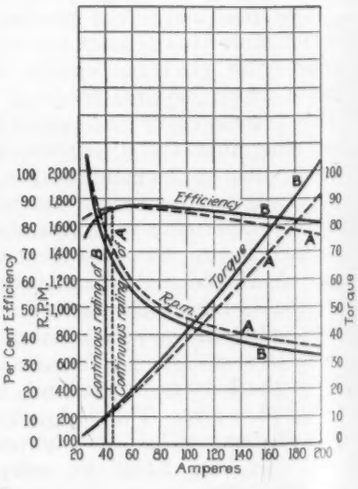


Fig. 5—Two motors of approximately the same size and weight but differing in torque and efficiency characteristics.

TYPICAL EXAMPLES OF TRUCK MOTOR CHARACTERISTICS

one may have a lower continuous rating and yet may operate the truck over a given route with less heating and less battery consumption. Fig. 5 shows performance curves of two motors of approximately the same size and weight and having continuous ampere ratings which are nearly the same. The motor "B," however, which has the lower continuous rating, has a performance which will result in less heating and less battery consumption over the typical truck route. Motor "B" has armature and field conductors of larger cross-section and has twice as many brushes as motor "A." At the continuous rating motor "B" has more losses than motor "A," due to higher brush friction and more iron losses in the armature teeth. The greater tooth loss is due to greater flux density in the teeth, more space being taken up by the armature copper in this motor. At heavier loads the I^2R loss in copper and brushes becomes a greater percentage of the total losses, and a point is soon reached (60 amp.) at which the efficiency of motor "B" is higher than that of motor "A." Since a greater part of the operation is at loads greater than the continuous amperes, motor "B" will show much less heating than motor "A" at the end of the route.

Since electric truck motors must operate for long periods with but little attention, they are of the totally inclosed type. The continuous rating could be increased considerably by making the motor self-ventilated, like the usual railway motor, but, as has been emphasized above, it is the condition of heavy loads, owing to frequent starting and accelerating, that the motor must be able to withstand. Under these conditions the ability of the motor to absorb the heat generated determines the temperature rise. This ability to absorb heat or thermal capacity is not increased by ventilating the motor, so that there is little practical advantage from this standpoint in doing so.

The voltage, ampere and speed ratings of motors required for different types of trucks are quite varied. The voltage rating is dependent on the number of cells and type of battery used. For street trucks the voltages are usually 80 to 85 for use with lead batteries and 60 to 70 for use with Edison batteries. For factory trucks and tractors the usual voltages are 24, 32, 36 and 48. The ampere rating is dependent on the output required of the motor, and the speed is dependent on the gear reduction connecting the motor to the driving wheels.

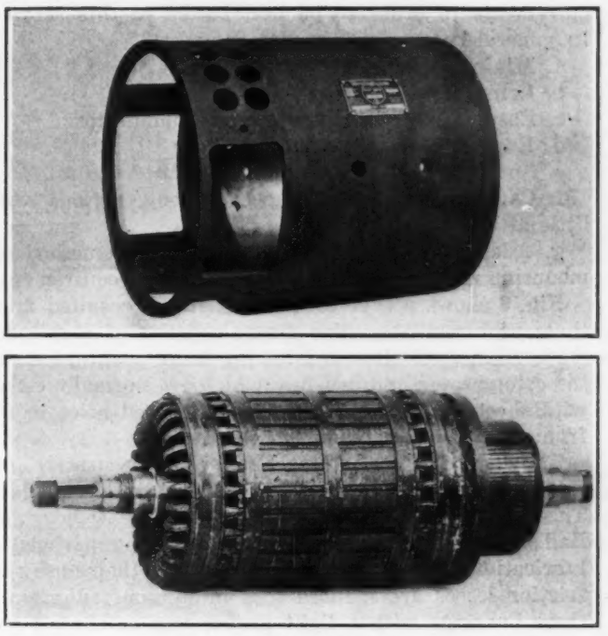


FIG. 7—TRUCK MOTOR DETAILS

Above—The openings around the commutator are punched in a flat-steel open-hearth plate; the plate is then rolled, welded and machined.

Below—The motor armature is well banded to withstand the high peripheral speeds.

For these reasons the motor to be applied to a certain electric truck is a motor designed especially for that truck, and the electrical parts can be so proportioned that it has the correct speed, high overload efficiency and high torque ratio.

MECHANICAL REQUIREMENTS

The motors used for propelling electric trucks are required to meet a number of special mechanical re-

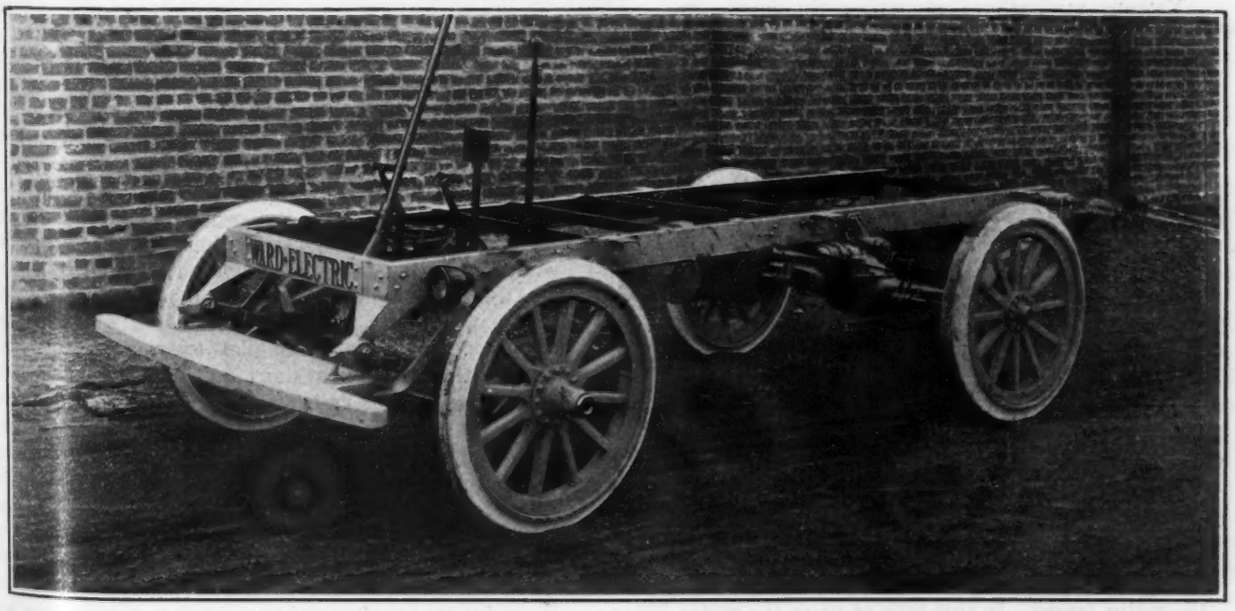


FIG. 8—MOTOR MOUNTING USING TWO UNIVERSAL JOINTS, A WORM GEAR AND DIFFERENTIAL

quirements in order to be best suited to this service. In general these requirements are:

a. Minimum weight.
b. Compactness.
c. Ease of access to brushes and commutator.
d. Ruggedness.
e. Simplicity of construction.
f. Capability of operating over long periods with little attention.
g. Adaptability to type of drive and method of mounting used by the truck and operating requirements.

Fig. 6 shows a type of motor that has resulted from these requirements. The frame consists of a cylinder made from steel plate and having large openings about the commutator and brushes, which are normally closed with sheet-steel covers. The radial tapped holes in the frame are used for mounting the motor.

The end housings are machined to fit accurately into the ends of the frame and are bolted securely in place. These end housings carry the armature ball bearings. Ball bearings are used because frequent periods of lubrication are not required and by their use the friction losses are reduced to a mimimum. Repacking these bearings with a light grease two or three times a year is all the attention they require, and many cases are on record where these motors have operated for years with no lubricant except that which was originally supplied by the manufacturer.

Four brush holders are used in the motor, which are accessible through four openings in the frame. The use of four brush holders rather than two permits a shorter motor and allows the use of a brush contact area sufficiently large to maintain high electrical efficiencies on overload conditions.

The armature is well banded to withstand the high peripheral speeds which are encountered at the higher truck speeds. The field coils used in electric truck motors are wound from insulated copper of square or rectangular section and are then bent in a press to a shape which will fit snugly in the cylindrical motor frame. The complete coil is covered with repeated tapings of insulating material and is thoroughly impregnated with insulating compound.

Various methods of mounting the motor are used

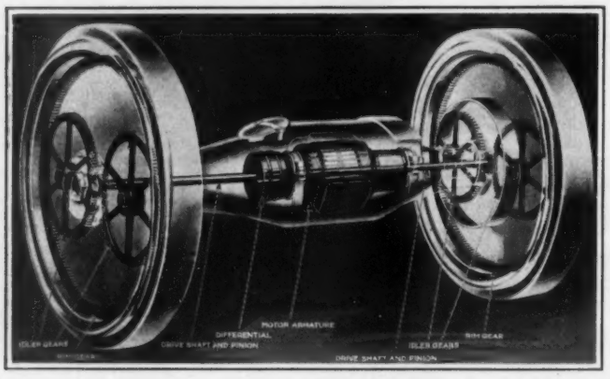


FIG. 9—BALANCE-DRIVE MOUNTING

by the different truck manufacturers, and the method of mounting is often a determining factor in the external shape of the motor. Fig. 8 shows one method of mounting a motor such as illustrated in Fig 1. Fig. 9 shows a method of mounting which very materially affects the motor frame. In this type of drive the motor differential and power transmission members are all embodied in parts of the rear axle and wheel assembly. Fig. 10 illustrates a motor and drive unit for a factory truck. In this type the motor has special end housings and is supported by them rather than by the frame.

The object to be obtained in any type of electric truck drive is that of getting the proper speed reduction from the motor shaft to wheels by a simple and rugged construction while still maintaining as high mechanical efficiency as possible.

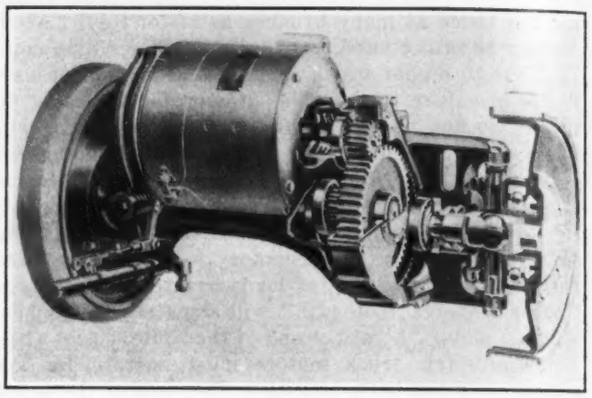


FIG. 10—MOTOR AND DRIVE UNIT FOR FACTORY TRUCK

From the foregoing remarks it will be seen that the application of the electric truck motors to different types of drives has very little effect on the shape of the electrical parts, so that the electrical design is not hampered for mechanical reasons. The exterior of the motor is affected and determined by the type of drive used, but is carefully worked out by truck and motor manufacturers together to produce the most substantial and durable construction.

Development of Austrian Water Power Lags Because of Dear Money

HOW seriously the development of water power is taken in Austria is illustrated by the great number of new stock companies. Since January 1, 1924, no less than 103 such companies, with a capital of 168 milliard paper crowns, have been formed. Among the largest of them are the Vorarlberg State Electric Company, with a capital of 21.6 milliard crowns; the Tyrol Hydro-Electric Company, capital 10 milliard crowns, and others.

The development of the Austrian water powers, however, is, above all, a financial question. The greatest drawback is the high rate of interest, 15 per cent—at present the highest in the world. Chief Engineer Dittes, director of electrification of the Austrian Federal Railways, recently delivered an address before the Austrian Engineers' Society in which he said that in 1923 the funds for the construction of the power station on the Lake of Spuller as well as for other electrification work ran short and that the electrification of the federal railways is dependent on the rate of interest at which money can be obtained. In consequence of the high Austrian rate of interest work on the electrification of the Tauern railway had to be stopped. It is quite out of the question that Austria herself will be able to exploit her water powers, but as the Austrian hydro-power stations offer very favorable economical advantages, it is hoped that foreign capital will in future be attracted in a higher degree than has been the case hitherto.

Installation of Malone Tower Anchor

Description of Construction Equipment and Methods Used in Building 37-Mile, 110,000-Volt Transmission Line of Virginia-Western Power Company from Charlottesville to Staunton

By M. J. IDAIL* and F. R. WELLER†
Washington, D. C.

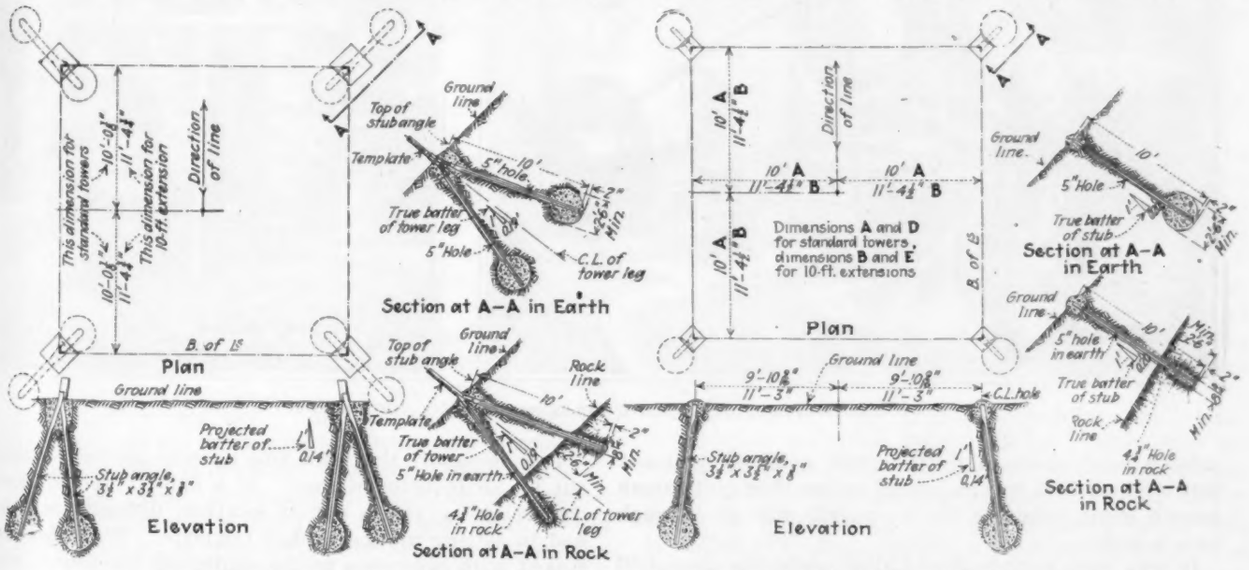
IN APPLYING the Malone tower anchorage to the 37-mile, 110,000-volt double-circuit Charlottesville-Staunton transmission line of the Virginia-Western Power Company a number of problems arose. This type of anchorage is rather new, and the line under consideration is, so far as the writers know, the second on which it has been extensively used. The line itself is constructed over the Blue Ridge Mountains. All sorts of earth conditions from clay and sand to seamy and solid rock were encountered. As there had been very little previous experience with this anchorage, it was necessary to develop methods as the job progressed and the problems arose.

A set of anchor legs for the anchorage consists of four 3½-in. x 3½-in. x ⅜-in. angles 10 ft. long deformed at the bottom and drilled at the top for connection to the tower. Holes about 10 ft. deep are bored for each of the four corner legs of the tower at the same batter as the tower legs. In earth this is easily done with a 5-in. post-hole auger. About three sticks of dynamite (40 per cent) is then exploded at the bottom of each hole, producing spherical cavities about 30 in. in diameter. The anchor legs are inserted in the holes and an anchor template is set up, the whole leveled and the holes filled up to the ground line with one-to-three cement grout. The template is not taken down until the grout has taken a good set, and at least two weeks is allowed to elapse before the tower is erected.

Before adopting this anchor for the Charlottesville-Staunton line the experiences on the first line used were carefully gone into, and in addition some special tests were made at the plant of the tower fabricator. In these tests a number of anchors of various sizes of ball set at various depths in earth were uprooted by means of a heavy traveling hydraulic-jack equipment.

These tests resulted in fixing upon average ultimate strengths in uplift as follows: A 10-ft. anchor, 30-in. ball, set with top at ground line, 70,000 lb.; a 7-ft. anchor, 30-in. ball, set with top at ground line, 40,000 lb. Failure of the anchor was considered as having taken place when it had been pulled up a distance of 2 in.

The standard tower on the Charlottesville-Staunton line is designed for two No. 4/0 A.S.C.R. circuits, with ground wire. It is 55 ft to the lowest cross-arm and weighs 6,600 lb. above ground. The maximum uplift per leg is 31,000 lb., thus giving an anchor factor of safety of 2.25. This is greater than is usually specified when grillage anchors are used.



AT LEFT—DOUBLE-BALL ANCHOR FOR TYPE C TOWERS. AT RIGHT—MALONE ANCHORAGE FOR 110,000-VOLT TOWER LINE

In earth it is a very simple matter to put the holes required for a tower down to the required depth. Two men with several earth augers of varying handle lengths and a wooden box template to keep the augering at the proper batter can auger the four holes down in two hours.

In the case of a tower site in other than earth—i.e., clay, loam, sand, etc.—the problem is quite different. An earth auger will not cut through hard pan, and even small stones may stop the cutting. Smooth rocks, shaly, rotten rock and hard solid rock each have to be treated differently.

*Electrical engineer. †Consulting engineer.

The rock holes on the first line on which this anchor was developed and used were drilled with a tripod drill and portable air-compressor equipment. Instead of such an outfit it was decided to use a rotary core drill similar to that used in exploring for minerals. The first drill ordered was an Ingersoll-Rand type G-31 drill. This drill cuts a 4¾-in. hole. The drill head is belt-driven from a 6-hp. gasoline engine. The cutting is done by iron shot fed to the bit. Water must be fed continuously to the bit. The drill head, engine and pump mounted on skids weigh 2,800 lb.

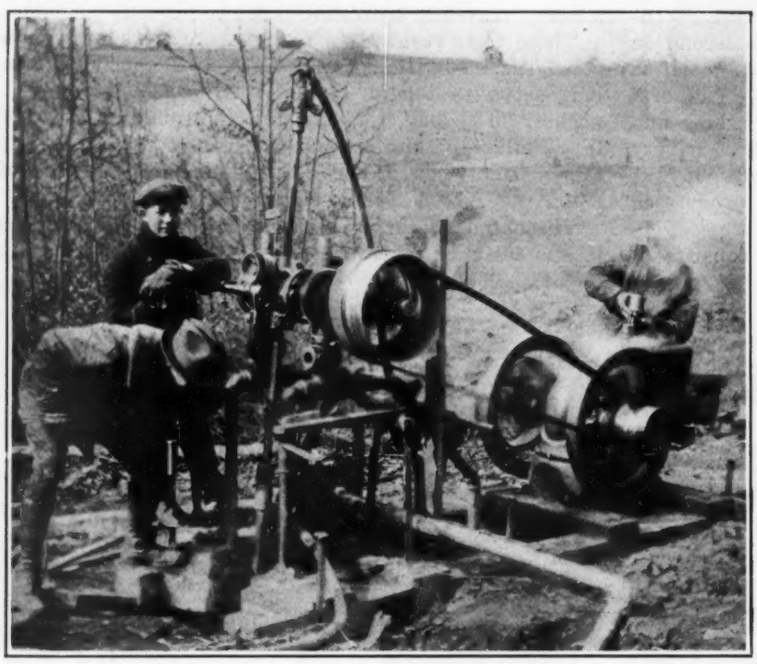
This outfit was selected in preference to an air-drill equipment because of cheaper first cost, lighter weight and probable lower operating and maintenance costs. Subsequent experience proved the wisdom of the choice. It is believed that a core drill will start a hole on a rock outcrop much more easily than will a tripod drill and that a tripod drill will glance off rather than go through smooth stone, whereas the core drill will go through such a rock.

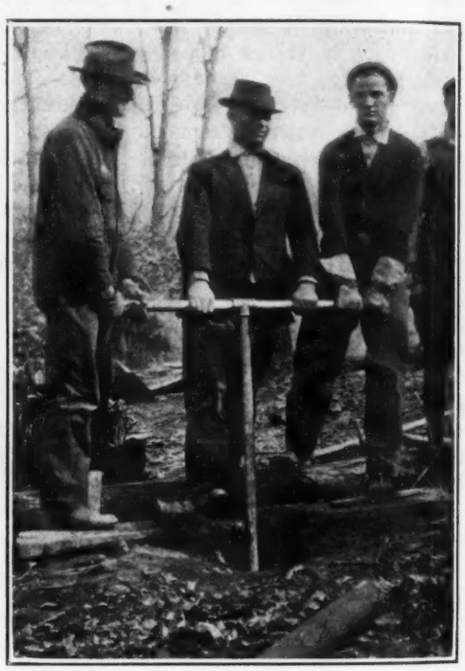
It was very quickly found that while the core drill performed satisfactorily on solid-rock holes, there were certain conditions for which it was not suited. For example, it took entirely too much time to set the drill up over a hole which had been augered from 7 ft. to 8 ft. and then found to contain rock for the several feet remaining. Also, it was very quickly found that a much larger percentage of the holes than was expected would contain rock. A hand method was required to supplement the engine drill.

At first 1¼-in. churn drills, lifted by two men and then dropped, were tried, the idea being to put a small hole through the rock and then to shatter the rock, or blow it out of the way, with dynamite. This was unsuccessful; the shot took effect in the direction of least strength and a jagged hole of no definite batter resulted.

Then 4½-in. churn drills were tried and proved to be the answer to the problem. These are four-point well-drilling tools, about 3 ft. long, weighing 150 lb. and threaded on the top to receive a 1¼-in. pipe handle. Handles of different length are provided. Three men raise the drill about 9 in. and let it drop. Water is kept in the hole. The drill pulverizes rock and mucks up hard pan. At intervals the hole is bailed. A crew consists of six men—three working and three resting. These drills can be worked only when the hole has been augered down at least 3 ft., thus providing a guide for the drill.

The method of procedure is as follows: The earth-augering gangs are sent on ahead to put the holes down as far as possible. The 4½-in. bull-drill gangs follow. These drills can put the holes down to the required depth through hardpan, pebbles, small stones, shale and rotten rock. If the bull drill hits granite or other solid rock, the bull-drill gang leaves the hole and the core drill later completes it.





TWO METHODS OF DRILLING HOLES FOR MALONE ANCHORS

It is necessary that each hole be very carefully staked out by an instrument man. If a hole is drilled more than 1 in. or 1½ in. out of location, difficulty will be had in setting up the anchor template. The holes are staked with reference to the center of the tower, correction being made for any slope in the ground.

In order to make the required progress a second core drill was placed on the job. This is a special G-3 drill in which are incorporated several improvements over the G-31. It has a heavier frame and drill head than the G-31. It is chain-driven, thus doing away with belt troubles due to alternate wet and dry weather. This G-3 drill has a heavy, reliable pump. Its cutting rate is about 50 per cent greater than that of the G-31. The weight of the G-3 is 3,500 lb. The lighter G-31 has a very considerable advantage over the G-3 when it comes to hillside work, and the two types taken together make a good combination. While the standard anchor is 10 ft. in length, a number of 7-ft. anchors were used where the anchorage was solid rock.

One drill runner and two men constitute a drill crew. These three men are necessary to skid the drill from one hole to another on the same tower. The drill is either skidded from one tower site to the next or is loaded on a farm wagon. It is necessary to place a

team and driver with each drill in order to keep it supplied with water and to move it.

The drill runners were trained on the job and were men without previous experience. These men made out remarkably well. There are, however, a number of tricks in keeping a drill running and cutting. Toward the last of the job an experienced drill runner was made drill foreman and more than justified his salary. Even with extreme care on the part of the man running the drill, the tools will occasionally stick in the hole and are likely to stay there unless the man knows just how to go about getting them out. An expert can quickly decide upon methods for particular situations. For example, on one of the first holes drilled the drill remained on one hole five days. There was a seam or cavity into which the shot rolled, away from the bit. Instead of fiddling around on such a hole, an experienced driller would have plugged the seam and filled the hole up with a mixture of plaster of paris and cement, and the next day would have redrilled the hole without trouble.

A combination of two Malone anchor stubs, framed to the tower leg at the ground line, was used on the 20-deg. angle and the line-stiffening type of tower. The maximum uplift per leg on this tower is 67,000 lb. Tests indicate the strength of the double ball arrangement, when set 10 ft. in earth, to be approximately 120,000 lb. This combination can be installed quite handily in earth, but requires great care in rock. Each of the eight holes must be staked out very accurately and drilled exactly, or the anchor template cannot be set up on the stubs. On a new line now under construction a 6-in. drill bit will be used on these double-ball anchors in the place of the 4½-in. bit. The slightly larger hole will allow for slight inaccuracy in staking or drilling.

Drilling Speeds

The footage obtained depends entirely upon conditions. In soft rock the bull drills can make a foot an hour. In hard rock the G-31 drill can make half a foot an hour. A stub-setting crew of foreman, six men and team can average from one and one-half to two tower anchors per day. This includes "shooting" the holes, setting up the template, mixing and pouring the grout and moving crew and equipment ahead.

It is of great advantage in installing this anchor if cheap sand can be dug from local beds and if water is obtainable at frequent intervals along the line. Cheap labor for manning the bull drills is also highly desirable.

No attempt was made to use the Malone anchor on the large angle and dead-end tower. Earth grillage anchors were installed under several other conditions:

1. Holes located near small streams, where gravel washed in as fast as it was bailed out.

2. When the drill tools stuck and could not be removed; in such a case the tools were dug out and a grillage was installed on the particular hole and Malone anchors on the other three legs of the tower.

3. In the case of one or two rock holes in an inaccessible place; in such an instance it is cheaper to use grillages than to spend time moving and setting up a drill.

Careful records have been kept of the foundation costs of the Charlottesville-Staunton line. Of the 236 towers, approximately 170, or 72 per cent, have Malone anchors. A conservative estimate of the saving made by installing these anchors instead of grillage anchors is $60 per tower, or $10,200 for the 37-mile line.

The Charlottesville-Staunton line was built for the Virginia-Western Power Company, Clifton Forge, Va., of which A. H. Grimsley is general manager, by Francis R. Weller, consulting engineer, and Frank A. Simmons, resident engineer.

Letters from Our Readers

Need for Simplified Power-Factor Terminology

To the Editor of the ELECTRICAL WORLD:

The units employed in electrical measurements are in no small degree responsible for a great deal of the mystery that envelops electricity in the non-electrical mind. For instance, the adoption of "ampere" as a unit of current instead of "coulombs per second" caused the almost universal misuse of the term "current" and in this way confused an otherwise extremely simple relation. Today, even among those who really know better, we find "current" used with many meanings—energy, power, electromotive force and electric quantity or electricity. For instance, the following are taken from writings of electrical men:

"The price of current is 10 cents per kilowatt-hour," in which case "current" is used for "energy."

"The current consumption of the motor is 10 hp.," in which case "current" is used for "power."

"The current flows through the circuit," in which case "current" is used for "electricity."

"They have a current of 110 volts," in which case "current" is used for "electromotive force" or "voltage."

Electricity flows in a circuit, and when the rate of flow is one coulomb of electricity per second, there exists in the circuit a current of one ampere. Current is flow, therefore cannot be said to flow, because that is the same as saying "the flow flows." It is so natural to think of a quantity flowing at a given rate through the circuit that in spite of the invention of a unit of current, the actual conception and use of the term by electricians indicates that they confuse current and electric quantity.

Now we come to power factor, a subject that is occupying many electrical utility minds. Technically the effects of power factor are understood and appreciated by all competent engineers. Commercially its effects on cost of service are almost as thoroughly appreciated by utility accounting experts, but before the subject can get proper attention and have proper remedies fairly applied the customer must also appreciate the significance of power factor and understand that while reactive or idle current costs money, it does no useful work for the utility company.

If there is to be peace and harmony between the customer and the utility, the customer must admit the fairness of the utility insisting on better power factor and must accept his share of the responsibility in return for his share of the benefits that will follow an improvement in power factor. To determine in just what proportion both responsibility and benefit shall be divided, measurements must be made and in such a way that the lay mind can accept these measurements as correct and just.

Power factor itself is a percentage and therefore requires an understanding of the factors of which it is the quotient. Reactive component requires an explanation of the vector relation between current and electromotive force. It seems to me that since the power-factor control must be enforced by measure-

ments, the measured factors will always be the reactive and power components of energy, and where possible these qualities will be related to one another by measurements that will permit the comparison at all times of the maximum demands which will give the relation between power factor and load.

As far as the customer is concerned, it seems sufficient for him to know that there are two kinds of electricity. One is measured by a watt-hour meter and represents the work done in his circuits; the other may be measured by exactly the same type of meter as the power component, but is designed in such a way as to measure only the reactive component. This electricity, while required in the operation of certain electrical machines, does no useful work, and yet it occupies just as much capacity in generators, transformers, conductors, switches, meters and all electrical circuits as the electricity which does a useful work. Furthermore, the reactive current can be supplied by other apparatus (power-factor correction) and need not come from the distant power plant.

No name has been officially adopted for the meter that measures the reactive component of energy nor for the units that are recorded upon the dials. We have standardized on the power component of energy, calling the meters "watt-hour meters" and the units "watt-hours." I wish to suggest in the interest of simplicity that we call the meters which measure the reactive component of energy "wattless-hour meters" and the units "wattless-hours."

Whether or not this particular suggestion is a good one is of little importance. The main thing is that some simple term should be adopted and universally employed as a means of simplifying and standardizing power-factor terminology.

O. A. KENYON,
Vice-President.

Ray D. Lillibridge, Incorporated,
New York, N. Y.

Economics of Power-Factor Correction

To the Editor of the ELECTRICAL WORLD:

Raymond C. R. Schulze of the Duquesne Light Company in your issue of January 24 repeats with approval his earlier statement that low power factor will entail the increment cost of larger turbo-alternators plus a percentage of this cost to account for the larger boilers, buildings, etc. Low power factor in itself does not require any greater boiler capacity. If there is a substantial increase in line losses, etc., outside of the station, because of excess kva., that increase may conceivably require an increase in boiler capacity. In practice it never so happens. Neither will low power factor in itself require a larger turbine, but only a larger generator. Why buy more turbines when it is only more generator that is needed?

In the case assumed by Mr. Schulze the output of an old plant is limited by the heating of the existing generators. By assumption each old turbine is good enough. What is the matter with swapping the old generator for a new one? With careful preparation the swap can be made at a week end. A modern generator, with plenty of capacity, will certainly cost a great deal less than $100 per kva.

If the old generator can be spared long enough to put it into the shop and 10 to 15 per cent additional capacity will be ample, there is probably another alternative; namely, to refit the stator with the newest type of winding, having insulation which will stand a higher temperature; to improve ventilation and reduce iron losses in the rotor by a little machine work, and to make a few changes of details in the field winding. That sort of thing may be all that is requisite, and it is worth doing anyhow when the machine comes to need rewinding.

In an old station such as is presumed it would probably be worth while to swap both turbine and generator, setting the new outfit on the old foundation with small alterations thereof and, of course, connecting it to the old condenser. That job cannot be done at a week end, but it does not take very long, and inasmuch as no new accessories are required, the cost will still be below the figure used by Mr. Schulze.

I very earnestly object to the statement that the investment in electrical plant is proportional to the kva. on the generators as a premise in any discussion of the cost of low power factor to existing electrical supply companies, or when it appears in any discussion of possible costs of correction of low power factor. That statement is only accidentally and approximately correct in any case. I think I have shown that it is an unwarranted and misleading statement in a discussion of the stated problem.

ALEX DOW.

Detroit Edison Company,
Detroit, Mich.

Cramp Company Denies Brown-Boveri Negotiations

To the Editor of the ELECTRICAL WORLD:

In your issue of February 14, page 364, under the caption "Brown-Boveri Plans," there is a statement that "Recent developments of the plan to form an American corporation affiliated with Brown-Boveri interests and holding the patent and sales rights of the Swiss manufacturing company, though financed and organized in this country, are that negotiations are under way with the Wagner Electric Corporation, William Cramp & Sons and several other firms." It is further stated that "According to Laurence Wilder, who is handling the negotiations for the Brown-Boveri interests, William Cramp & Sons are also considering entering into the plan."

We desire to advise you that as far as the William Cramp & Sons Ship & Engine Building Company is concerned no such negotiations are under way and there is no foundation for the statements quoted.

J. H. MULL,
President.

The William Cramp & Sons Ship & Engine Building Company,
Philadelphia, Pa.

Details of Miami Fort Generating Station

To the Editor of the ELECTRICAL WORLD:

Certain errors occurred in the article on the Miami Fort power station published in the December 20, 1924, issue of the ELECTRICAL WORLD which the following statement should clear up:

Two 40,000-kw. tandem turbines (fourteen stages high pressure, twelve stages low pressure) will be installed. The exhaust from the fourteenth-stage or high-pressure turbine will pass to the reheat boilers at 120 lb. absolute, 424 deg. F. total temperature. The steam from the reheat boilers will be returned to the fifteenth-stage nozzle bowl or low-pressure turbine at 110 lb. absolute, 725 deg. F. total temperature. The turbines will be bled at the eighteenth, twenty-second and twenty-fourth stages.

This statement is to correct the impression regarding the number of stages in the high-pressure turbines and to emphasize the fact that the turbine is to be bled at four points only.

C. W. DE FOREST,
Vice-President.

Columbia Power Company,
Cincinnati, Ohio.

Central Station and Industrial Practice

Record System for Meters and Transformers

A VISIBLE record system used by the Great Western Power Company has been found to increase speed and accuracy in the keeping of meter and transformer records. The device, which was designed by H. P. Wellman of San Francisco, is shown in the accompanying illustration.

To each meter when received from the manufacturer is given a company number in addition to the manufacturer's number. This is entered in an ordinary stock record subdivided by "makes," "sizes," "types," etc. The numbers are recorded in a manufacturer's number book by numerical order of manufacturer's number with the company number to the right, as a cross index, in the event the company number should become defaced or unreadable on the meter. As each meter is taken from stock and placed in service it is recorded on a visible-record sheet, buff in color, 4¾ in. x 10½ in., a sample of which is shown herewith. At the bottom of this sheet are typed the manufacturer's number, make, type, amperes, volts, number of wires and company number in such manner that these data are always exposed in the visible-record book, the company number being in the lower right-hand corner.

At the top of this sheet are recorded in longhand the date of installation, the name and address of the consumer, the sales number and other necessary data. Eighteen additional spaces are provided for meter transfers. These buff sheets, known as "company number meter records," are carried in numerical order of company number in the visible binders, approximately 1,150 to each binder.

METER-RECORD SYSTEM WHICH GIVES ONE CLERK INSTANT ACCESS TO 46,000 METER RECORDS

Forty binders are carried on a revolving-wheel rack which projects conveniently over the rear of the meter clerk's desk in such a manner that 46,000 meter records are instantly accessible to the operator. This, of course, is very much more rapid than the vertical card index owing both to instant accessibility and to the fact that the visible-record system is much more rapid than the vertical card system. Transfer records are made on these sheets from sales orders which are sorted in numerical order each day before recording to avoid all possible removing and replacing of binders on the revolving rack.

A telephone conveniently placed on the desk of the meter-record clerk enables him instantly to answer a question from the field by having quick access to 46,000 meter records without leaving his chair. Meter testing dates are recorded at the time of installation in a loose-leaf "tickler" book dated to cover a period of six years. Meter test reports are recorded in a column provided for "test record" on the "company number meter record," where they will always be instantly accessible for reference.

An important feature of this system is the record of instrument transformers. An orange-colored signal, 3 in. x 6 in., is used for potential transformers, and a green signal of the same size is used for current transformers. These signals carry a complete description of the instrument transformers and are filed in the visible-record binder with the meter affected, giving instant information at the time of reference to the "company number meter record" of the use of the instrument transformer. This has

TEST RECORD			COMPANY NUMBER METER RECORD									
DATE	TEST NO.	NATURE	DATE	NAME AND ADDRESS	TOWN	K.W. LIGHTS	K.W. HEAT	K.W. POWER	TRANS. NO.	DIAL CON.	S.O. NO.
8/7/21	4956	N	12/7/21	Burt, Walter. 1030 Bush Street	S.F.	6				1	44447
7/8/23	12956	Route.									

REMARKS	MANUFACTURERS' NO.	MAKE	TYPE	AMPS.	VOLTS	WIRE	COMPANY NO.
	666b643	G E	I-14	b	110	2	35685

FORM OF METER RECORD SHEET USED IN BINDERS CARRIED ON REVOLVING HOLDER

been found to be decidedly better than to carry instrument transformers in a separate card index.

Distribution transformers are recorded on a blue sheet the same size as the "company number meter record" and are filed by company number in the visible-record binders. The method of recording description and transfer from one location to another is essentially the same as in the case of the electric meters.

Construction Methods Used in Building 132,000-Volt Line

BY G. W. CHAMBERLIN
Commonwealth Edison Company, Chicago, Ill.

THE tower construction of the 132,000-volt transmission line tying together Insull properties around northern Illinois and Indiana is being done by the operating companies in their own territories. Twenty-five towers of the line are in the city limits of Chicago and were erected by the Commonwealth Edison Company. From an economic standpoint it was decided to assemble them in the air. Assembling towers on the ground requires equipment for raising them which is expensive and could not be used in the average line construction in a large city. Therefore the investment for such equipment was not considered warranted on the Edison system.

The Commonwealth Edison Company's right-of-way for this line is an old lake bottom and practically all quicksand except for about 6 in. of rotted vegetation on top. Therefore footings for the towers erected by this company had to be carefully designed and well constructed. Owing to these conditions it was impossible for trucks to deliver material at each tower location. Convenient locations near by were selected for unloading the materials, which were hauled to the tower sites on an oil field wagon by means of caterpillar tractors. These tractors, one of which is equipped with a winch driven by the tractor engine, are also used in raising equipment, pulling forms and caissons and moving the tools along the right-of-way.

In digging for the footings caissons were used which are 8 ft. deep and 8 ft. in diameter, made of steel in four vertical sections so as to be removed easily when desired. The sections are bolted together, a piece of rubber being inserted between the edges of the sections to exclude water. The assembled caisson was set up and centered for the footing, a transit being used for centering. Digging on the inside was then begun, the weight of the caisson being sufficient to sink it as the dirt was removed. Four holes were dug for each tower, ranging from 9 ft. to 12 ft. deep, depending upon the type of tower (dead-end, semi-strain or suspension) to be erected. Suction pumps and sand points were kept in operation during the digging, as the water level is just below the surface. Thirty-three men were used in this work because, owing to the water conditions, each operation had to follow directly after the completion of the one previous.

After the hole was dug the forms for the concrete footings were placed inside the caissons and concrete poured from a concrete mixer directly into the forms. The footings range in depth from 8 ft. to 11 ft. and are 20 in. square on top and from 4 ft. to 7 ft. square at the bottom. The concrete was allowed to set twelve hours; then the caissons were removed, taken to the next tower location and the hole backfilled. A minimum time of seven days was allowed for the setting of the concrete before tower erection was started on the footings. Two and one-half days was the average time required to deliver the materials, dig, pour the concrete and complete the footings for a tower. This work was done by the conduit division of the street department.

To erect the towers the overhead division used one of its regular construction gangs consisting of nine men, a foreman, four linemen, three groundmen and a chauffeur. The corner legs of the first two sections

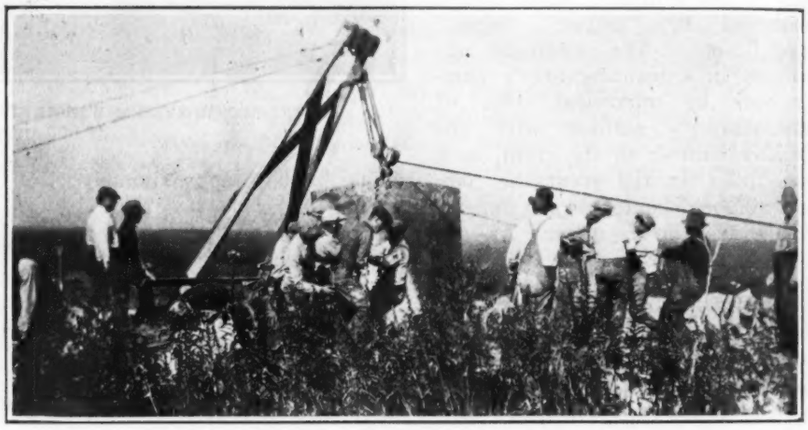
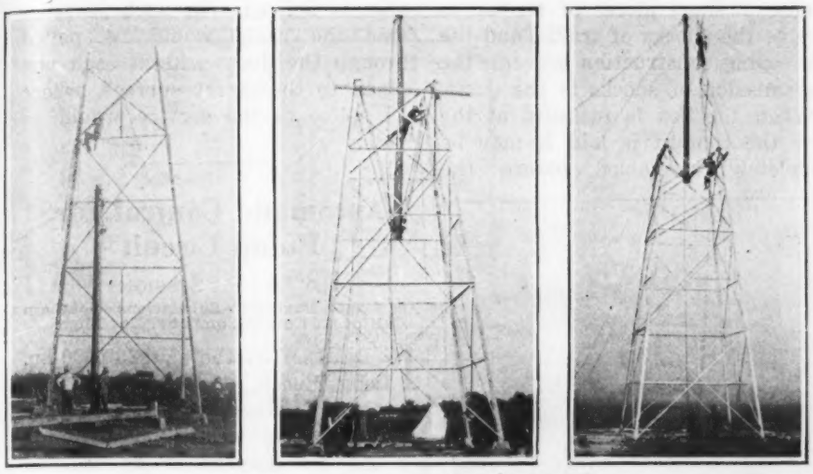


FIG. 1—HANDLING CAISSON USED FOR EXCAVATING FOR TOWER FOOTING

FIG. 2 (AT LEFT)—CATERPILLAR TRACTOR HAULS MATERIAL ON TRAILER WITH CATERPILLAR WHEELS. FIG. 3 (AT RIGHT)—CATERPILLAR TRACTOR WITH POWER-OPERATED WINCH USED IN RAISING EQUIPMENT AND PULLING CAISSONS



THREE STAGES IN ERECTING TOWERS

Fig. 4 (at left)—Half of lower tower section being raised to position. Fig. 5 (in center)—Lower section completed and gin pole being hoisted to erect remainder. Fig. 6 (at right)—Gin pole raising part of second section into place.

of a tower were laid in opposite directions on the ground with their legs at their respective footings and the sections laced together in halves. The halves were then raised to positions one at a time and bolted to their respective footings, after which the halves were laced together. Erection was accomplished by means of a 30-ft. gin pole set in the center of the four footings. A 1-in. rope was fastened to an assembled section, threaded through a snatchblock at the top and bottom of the gin pole and run to the niggerhead of the winch on the front of the tractor. For erecting the third section the gin pole was raised to the top of the second section, where it was supported by four sets of 6-in. two-sheave blocks (threaded with 1-in. rope) which are fastened to each corner of the tower. The top was guyed four ways with rope while the pole was being raised; when it was in position the ropes were fastened securely to temporary anchors. These guys were paid out by a man on each rope while the pole was being raised.

The height of the first two sections is approximately 45 ft. The third-section corner legs, being the heaviest single pieces, were raised, one at a time, bolted in position and laced together in the air. The gin pole was again raised to the top of this section, which is 62 ft. in the air, and the fourth section laced together in halves on the ground, raised, bolted in position and interlaced. Then the top, arms and braces were placed in position and bolted.

The insulators were raised and hung as the last operation. A double string of insulators consisting of nine shells each was used for each wire on dead-end and semi-strain towers, and a single string of eight for suspension towers.

The height of the towers, when completed, is from 92 ft. to 96 ft., depending upon the type of tower. The average time for erecting a tower was approximately three days for the twenty-five towers in the Edison territory. The men became more and more proficient as the work progressed and are now erecting suspension towers, including insulators, in two-and-a-half days and dead-end towers in three days.

The overhead division also laced and erected the steel of the outdoor substation, which consists of nine columns (3 ft. square and of various heights ranging from 50 ft. to 60 ft.) and twenty-five interconnecting girders. The steel for this work ranged in length from 6 in. to 20 ft. and was shipped in two carload lots. At the substation it was possible to use the company's standard electric truck equipped with an electric winch for raising the equipment. The columns and girders were assembled on the ground. Then the columns were raised to position on their footings and bolted, and the girders were subsequently raised and bolted in place.

Praise is due the men working on this line for their ability to adjust themselves quickly to unusual conditions and to perform work which is out of their general routine.

Underground Service Box for Distribution

THE increasing demand for underground service, particularly in new residential developments, has made it extremely desirable to develop a low-cost distribution conduit system for secondary cables. Various types of conduit may be used, such as fiber, pump-log, tile or concrete (either pre-cast or monolithic), the relative costs of the construction depending somewhat upon local conditions. A large item of cost in such a system is the distribution box and lateral expense. The plan usually adopted is that shown in Fig. 1, where boxes are installed at convenient intervals and laterals run from these boxes paralleling the main ducts to a point opposite the building to be served and then turning at right angles into the building to be served.

Obviously a considerable saving in duct and cable cost could be made by installing boxes in the main duct

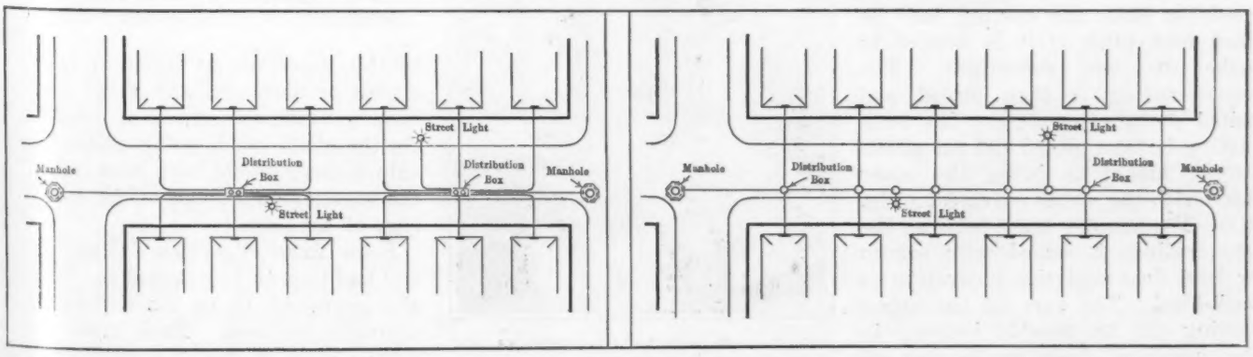


FIG. 1 (LEFT) AND FIG. 2 (RIGHT)—TWO METHODS OF TAPPING OFF DISTRIBUTION SECONDARIES

opposite each building, and this saving would be still greater in the case of a building to be served from an old conduit system where the cost of excavation, pavement, etc., parallel to the duct line, would be avoided. However, in the past the cost of suitable boxes has more than offset the saving effected by their use and the plan in Fig. 1 has been generally used.

A box has been developed recently which, because of its low cost and ease of installation, makes possible the use of a system designed as shown in Fig. 2. The total cost of such an installation is considerably less than that shown in Fig. 1, and new services may be added with a minimum of excavation and pavement restoration. The other illustrations show the box as used with pump-log conduit, but it can be arranged for use with any form of conduit construction equally well. The box consists essentially of a base of creosoted lumber, spacing blocks of pre-cast concrete or creosoted lumber, a lower casting, a neck casting and a cover.

To install such a box in an existing conduit system a small excavation is made at the proper location and the ducts are cut away, leaving a space of 12 in. between the ends. The base piece is then placed under the ducts as shown in Fig. 3A, and the four stud bolts are threaded into nuts which are permanently fastened to the under side of the base piece. The four corner blocks and the service laterals are then set in place as shown in Fig. 3B. If service is required from only one side of the box, a dummy block may be installed on the other, or the duct may be plugged. Short lengths of cable, long enough to reach to the street surface, are spliced to the main cables and the service cable is pulled, leaving enough slack to reach to the street surface, where a splice to the taps from the main is made.

The spaces between the blocks, conduits, base and casting may be filled with pitch if it is desired to make the box watertight. The lower casting is then placed and bolted down (Fig. 3C). The neck casting is then placed and set at the proper height to bring the cover flush with the street pavement (Fig. 3D). The annular space between the two castings is calked with oakum or lead floss and the excavation is back-filled. The ears on the upper casting are to provide bearing in the pavement base or to rest on stones or short pieces of timber to receive the shocks of traffic, and the telescoping construction prevents the transmission of shocks to the ducts.

When the box is installed at the time the conduit is laid it may be completely assembled before the cable is spliced. In such installations the cable would be pulled through the ducts and at each box looped to the street surface, where the splice to the service would be made.

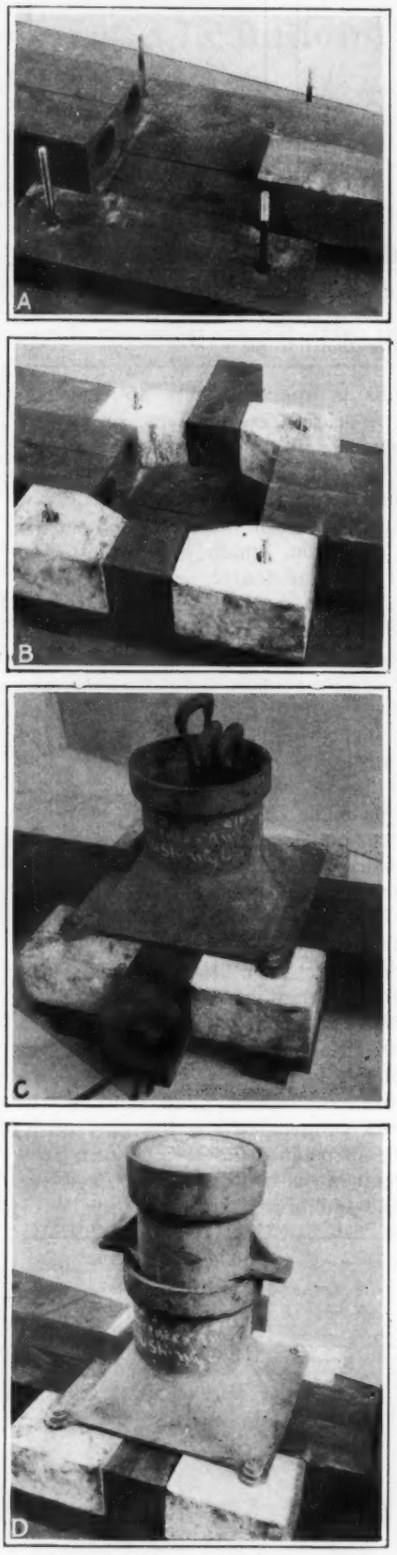


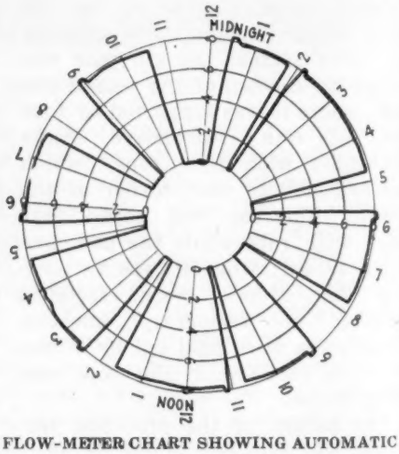
FIG. 3—BOX ESPECIALLY DESIGNED FOR SECONDARY WORK

Automatic Control for Pump Circuit

BY A. P. SESSIONS
Assistant Engineer Substations Southern California Edison Company, Los Angeles

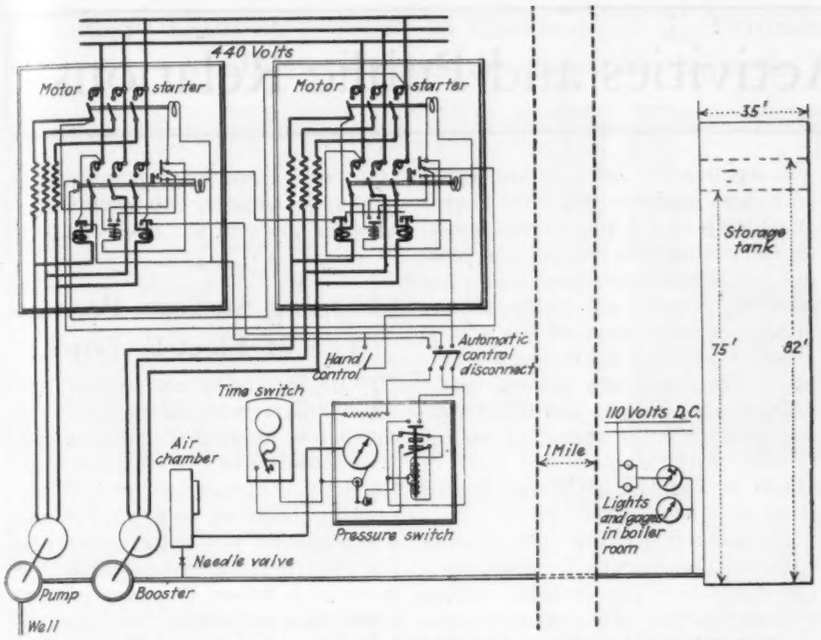
IN BUILDING the new 200,000-hp. Long Beach steam plant of the Southern California Edison Company peculiar local conditions resulted in the development of an unusual automatic control for the fresh-water-well pumps. This brought about the elimination of an expensive control circuit and a charge for labor attendance of about $400 a month.

The necessity of installing the pumps about a mile from the steam plant across a ship channel made the ordinary float-switch control expensive and undesirable. If the control circuit had been carried across the ship channel, it would have been necessary to put it on 185-ft. towers very close to the 60-kv. transmission circuits in order to clear shipping in the channel. This proximity of the control circuit to high-voltage lines would have induced considerable potential, especially at times of short circuit or flashover, and would have been a continual source of trouble. On the other hand, going under the ship channel would have been out of the question on account of the operation of dredges.



FLOW-METER CHART SHOWING AUTOMATIC OPERATION OF FRESH-WATER PUMPS

Some form of pressure-gage control had then to be resorted to. This also promised to be more than an ordinary problem. Each time the pumps were started the draw-down



AUTOMATIC CONTROL FOR FRESH-WATER PUMPS, LONG BEACH STEAM PLANT

of the water in the well after twenty minutes' pumping caused the delivery to decrease from 800 gal. to 750 gal. per minute. This decrease in friction head in the pipe line amounts to something more than the normal increase in static head in the storage tank due to pumping; consequently a simple pressure-gage control would have failed to function.

A scheme was considered involving a compound gage which would take varying friction head into consideration, but this idea was abandoned for a combination pressure gage and clock control, which was considered less delicate and more reliable. This arrangement was installed at the pump house and has been operating satisfactorily since Dec. 1, 1924.

The following is a description of the control system as installed: A sensitive contact-making pressure gage was connected through an air chamber and needle valve to the discharge line from the booster pump as shown in the accompanying diagram. This gage is adjusted to start the pumps when the back pressure in the pipe line reaches a value corresponding to a head of 82 ft. in the storage tank at the plant. There is sufficient space in the tank above this level to hold practically a three hours' run of the pumps without overflowing. The pumps are then shut down automatically at the end of a three hours' run by a self-winding clock and remain down until the water in the storage tank reaches the 82-ft. level, when they are again started by the pressure gage. A sample flow-meter chart taken from the pipe line illustrates the pumping cycle.

To prevent failure of water supply without notice, a contact pressure-gage lights two lamps on the boiler-room operating board if the water in the storage tank reaches a depth of 75 ft. An indicating depth gage is also placed on this board. The recording flow meter gives a continuous record of operation, and a man calls at the pump house every few days to inspect equipment.

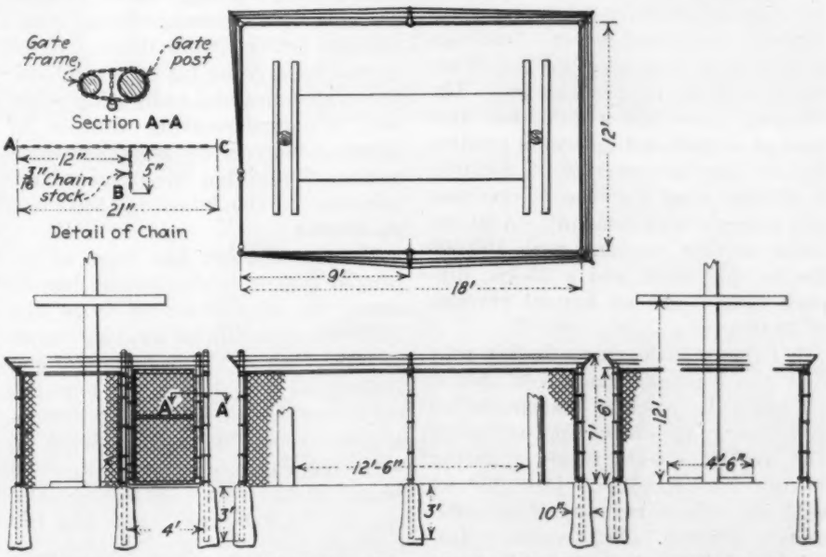
Checking Specifications of Circuit Breakers

WHEN ordering or making out specifications for oil circuit breakers, one light and power company in the East uses the tabulation given herewith so that no item shall be overlooked. It is kept in a convenient file and is always available, no matter how quickly the specifications have to be drawn up.

SPECIFICATION CHECK LIST FOR OIL CIRCUIT BREAKERS

1. Type and form.
2. Number of poles.
3. Single or double throw.
4. Catalog number.
5. Amperes.
6. Volts.
7. Operation—hand or electrical.
8. Control—direct or remote.
9. Automatic or non-automatic.
10. Indoor or outdoor.
11. Tanks arranged in tandem.
12. Tanks arranged in parallel.
13. Mounting—panel, floor, cell, pipe frame or panel-pipe frame.
14. Type of frame—angle or pipe.
15. Cell, doors, hardware, etc.
16. Solenoid:
    - (a) Alternating-current or direct-current voltage.
    - (b) Control relay.
    - (c) Tripping relay.
    - (d) Auxiliary switches for lamps or interlocking.
    - (e) Emergency closing handle.
17. For manual operation:
    - (a) Operating lever (cover plate).
    - (b) Trip coils—number, amperes, volts.
    - (c) Bell cranks.
18. Bushing current-transformer nominal ratio (for General Electric breakers).
19. Overload trip mechanism.
20. Inverse-time-limit trip attachment.
21. Tank lifter.
22. Oil—kind and amount.
23. Rupturing capacity at service voltage and at rated voltage.
24. Price.
25. Weight.
26. Delivery data.
27. Outline dimensions and foundation plan.
28. Where shipped to.
29. Rebate for oil drums.

Transformer Fence Used by West Penn Company



SINCE the "Overhead Distribution Construction" series was run in ELECTRICAL WORLD during 1924 several additional standards have been adopted by the West Penn Power Company. Among them is the above for standard transformer fences. In all cases where practical, a 2-in. layer of cinders should be spread around the concrete base to the distance of about 1 ft. outside the fence.

Commercial Activities and Public Relations

Pacific Gas & Electric Seeks Load Diversification

BY H. E. SANDOVAL
Manager Electric Sales, Pacific Gas & Electric Company, San Francisco, Cal.

BECAUSE of the large amount of hydro-electric power that will be made available during 1925 by the addition of 100,000 hp. from the Pit River No. 3 development and approximately 40,000 hp. to be purchased from the California Oregon Power Company, the electric sales department of the Pacific Gas & Electric Company has launched an aggressive sales campaign to develop high-power-factor, high-load-factor, off-peak loads of the most desirable type.

Sales work will be grouped under four divisions, with a sales engineer in charge of each, as follows:

1. Illumination.—The engineer in charge of this work will devote all of his time to lighting problems, including domestic and commercial lighting, industrial lighting, sign lighting, exterior lighting, street lighting, etc.

2. Power Sales.—A recent survey shows that there is approximately 25,000 hp. in isolated plants operating within the reach of the lines of the company, with an estimated annual revenue of $400,000.

3. Industrial Heating and Electric Transportation. — These fields offer an opportunity for high-power-factor, high-load-factor business, and in many instances such loads are on during the off-peak period. The company now has a 2,000-kw. furnace at a steel-casting works producing an annual revenue of $32,000. A similar-sized furnace is operated by a large railway company. A 60-kw. brass-melting furnace uses 100,000 kw.-hr. per year, and a 25-kw. dipping tank earns an annual revenue of $3,000.

During a little more than a year past the company has given special attention to electric transportation and there are now approximately 150 electric street trucks operating in the San Francisco Bay district with an annual revenue of approximately $20,000. Fifty-seven industrial electric trucks operated by large steamship companies produce a revenue of $4,788 annually.

4. Appliance Sales. — An appliance sales engineer will have charge of all lamp socket appliances, domestic and commercial heating and cooking and domestic refrigeration. Appliances, ranges and water heaters produce a large part of the annual gross revenue on the company's system. There are now approximately 5,800 electric ranges and 2,700 electric water heaters operating on the system, with a connected load of 54,000 kw. and an estimated annual revenue of $400,000.

Commercial cooking and heating offers an opportunity for high revenue business. The company serves a large number of commercial bake ovens of 15 kw. to 50 kw. installed capacity.

Domestic electric refrigeration has become very active within the last year. One large manufacturer sold approximately 300 machines and another one sold 125 machines.

Charging Stations Promote Use of Electric Truck

THE utility of an electric truck is materially increased by the convenient location of charging facilities. There are now thirty-five stations in Chicago where facilities ranging from 40 amp. to 250 amp. are available for battery charging. The electric truck bureau of the Commonwealth Edison Company has published and distributed to users and prospective users of electric trucks a map of the city with all charging stations indicated, giving details of charging facilities available.

New Lighting Institute

Permanent Exhibit of Modern Lighting Practice Made Available for Use of the Electrical Industry at Harrison, N. J.

AS A FURTHER means of advancing knowledge of modern lighting practice the Edison Lamp Works of the General Electric Company has just completed and thrown open to the use of the electrical industry its Edison Lighting Institute at Harrison, N. J. This institute will function as an experimental laboratory, working demonstration and school of merchandising practice for better illumination. It will be particularly useful to central-station companies and to lighting salesmen in supplementing courses of lighting instruction as it affords a means of studying the practical application of the latest methods and equipment.

The installation has been so arranged that it is possible to demonstrate the ever-widening scope and influence of artificial lighting in all phases of industrial, commercial and residential use. To show how the equipment should be utilized demonstration rooms have been fitted up with appropriate furnishings as shown in the views on the opposite page. The exhibits include the following:

Reception Room.—In this room of the institute an exhibit of lamps used at different periods in history traces progress in the science of lighting from the early ages to the present day.

Auditorium.—This is a large room so arranged and equipped that complete demonstrations can be made on any subject pertaining to general lighting.

Industrial Lighting.—A demonstration of five different types of industrial lighting showing typical equipment used in various fields.

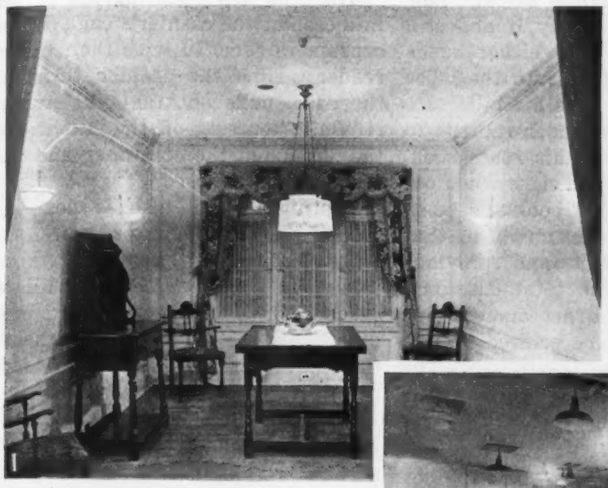
Street Lighting.—Two model miniature streets are used to demonstrate "white-way" or business section lighting and residence street and highway lighting. An exhibit of the principal types of poles, brackets, pendent and ornamental fixtures, glassware and control and operation accessories.

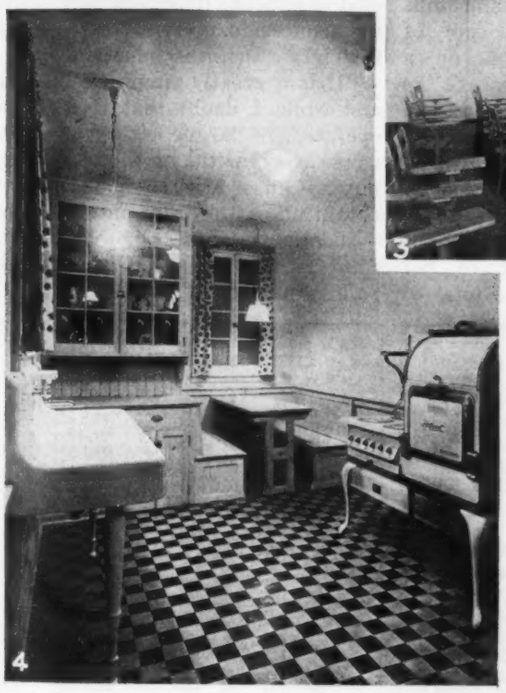
Store Lighting.—In a model store are shown the advantages of good lighting and the disadvantages of poor lighting in the sale of merchandise; and a demonstration of how the appearance of a store may be changed by the use of high-level illumination.

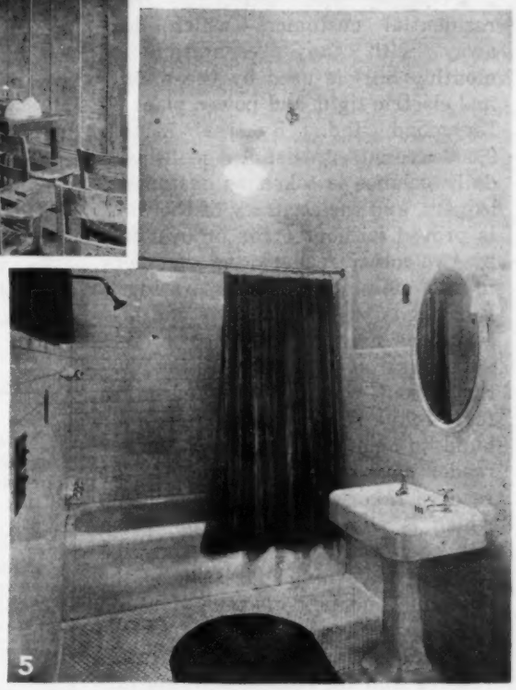
Home-Lighting Apartment. — Five model rooms—a living room, bedroom, dining room, kitchen and bath—have been furnished to demonstrate a great variety of methods and types of lighting that may be employed to make the home comfortable and attractive.

Concentrated Filament and Miniature Lamp Room.—This room is devoted to applications of miniature and concentrated filament lamps. Here are demonstrated different types of auto headlight beams, the effect of glare-reducing devices on these beams, control of light by special shape reflectors and the effect of manufacture and design of lamp

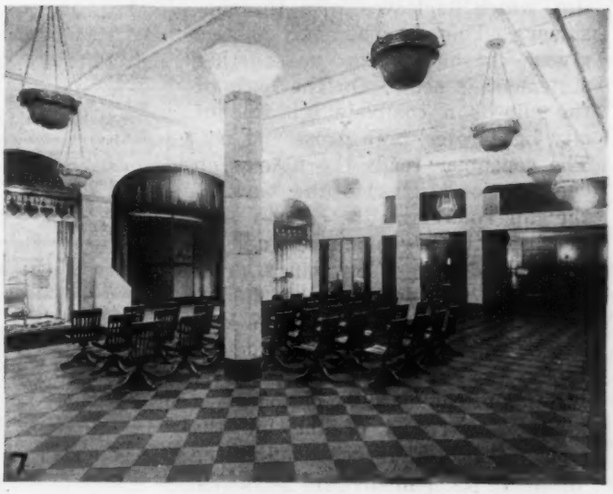
Edison Lighting Institute at Harrison, N. J., Provides Complete Facilities for Demonstrating the Latest Practices in Illumination







DEMONSTRATION rooms equipped by Edison Lamp Works of General Electric Company for use of the electrical industry. 1, 4 and 5. Dining room, kitchen and bath of five-room apartment. 2. Reception room. 3. Industrial lighting exhibit. 6. Miniature lamp and concentrated filament room. 7. Auditorium.



filaments on the resulting beam of light.

While it is expected that those in the electrical industry will probably make the greatest use of the facilities provided by the Edison Lighting Institute, its usefulness extends beyond this immediate field. It will be at the service of women's clubs, merchants' associations, manufacturers' associations, business clubs, chambers of commerce, electrical societies, schools and colleges, and will be open to all who are interested in lighting in any of its phases.

Billing Without Bills

How Two Meter Readers and a Clerk with Bookkeeping Machine Handle 9,000 Accounts.

A SIMPLIFIED method of meter reading and collecting from residential customers which does away with the presentation of monthly bills is used by the municipal electric light and power plant of Richmond, Ind. By this system 9,000 accounts are handled monthly, a daily balance is taken on customers' ledgers, and the accuracy of the work is proved without error or overtime by two meter readers and one clerk in the office, the clerk operating a Burroughs posting machine and also acting as cashier.

Meters are read continuously throughout the month. There are forty-four routes averaging four hundred meters, and each meter reader covers one route daily. The readers take with them a small slip which is shown here and on which has been addressographed the customer's name and address, also the date due and last discount date.

The meter reader places the present meter reading, last meter reading and the consumption on this slip, which he leaves with the consumer. This is the only notice given consumers as no further statement is sent. On the back of the slip is a complete schedule of city light rates, both gross and net. The consumer reads the figures on consumption, turns to the back of the slip, runs down the column until he finds the right amount and in that way discovers how much, gross and net, he owes for the month. Should the consumption be 27 kw.-hr., he will look on the back and see that if the bill is paid before the expiration of the discount period given at the lower end of the bill the amount will be $1.75, or, including the discount, the amount will be $1.89.

This slip carries all the information that a customer would receive on a regular statement. He learns from it when the bill is due and how long he can wait to pay it and still get his discount. He either sends in his check or steps into the office with the slip and pays his bill.

When the meter reader returns to the office he turns in his route book. The next morning the clerk who does the billing takes that book and posts the bills for the consumers on that route. The present and previous meter readings, the total consumption, the gross and net amount due and the discount are printed by two operations of the keyboard. The rest of the work of posting the ledger card and the necessary figures on the bill and cashier's stub are done automatically.

While the ledger card and bills are being posted a carbon copy of the figures is being made on a "recap" sheet that is underneath the bill. When the operator fills up one of those sheets she obtains a printed total at the foot of every column on the sheet. That gives her a proof of posting and a quick check on the work she has done.

To verify the accuracy of her work the operator adds the total of previous readings to total consumption. The result should be the total of present readings.

The bills after posting are placed in a case at the cashier's cage. When consumers come in with their meter reader's slips the cashier turns to the case, pulls out the bill, stamps it "Paid," cutting off the stub, takes the slip from the consumer and the transaction is closed.

Posting credits also is done by machine. The operator takes the stubs each day, arranges them, takes out the customers' ledger cards and posts the payments and date. A "recap" sheet underneath the ledger card enables her to check her work.

"In this manner," says F. E. Bescher, chief clerk of the Richmond plant, "we have eliminated a great deal of expense inasmuch as we have no invoices to mail out except to a few large business houses.

"It is a greatly simplified method, and while I doubt that it could be operated in larger cities, we have done away with much work that might cause errors, and still we obtain all of the information needed —such as is called for by all private concerns, although ours is a municipally owned plant."

(Customer's name and address here)

MELAPP No. 6

Present Meter Statement _____ K.W.

Last " " _____ K.W

Consumption - - - _____ K.W.

City Light Rate Schedule "A"

First 50 K.W.H. 7c (6½c net)
Next 150 K.W.H. 5½c (5c net)
Next 300 K.W.H. 3½c
Over 500 K.W.H. 3c
Minimum charge $1.00 per month)

City Power Schedule "C"

First 250 K.W.H., 5c (4½c net)
Next 250 K.W.H., 4c (3½c net)
Next 500 K.W.H., 3c
Next 4000 K.W.H., 2½c
Next 5000 K.W.H., 1½c
Over 10000 K.W.H., 1½c
Minimum charge $1.00 per month per meter or over 4 H P 25c per connected H. P.

Heating and Cooking Rate "C"

First 15 K.W.H, 7c (6½c net)
All over 15 K.W.H. 3c (2½c net)
Minimum charge $24.00 per year.
Customers must have 2000 Watts or more of electric heating load to receive this rate. Domestic appliances, such as Irons, Percolators, Toasters, Vacuum Sweepers, Portable Heaters, Washing Machines, Etc., as well as motors of ½ H.P. or less, may be connected on this rate.

SEE OTHER SIDE FOR AMOUNT OF YOUR BILL

PHONES 2114-2115 — Payment of Bills — Office Hours: 8 a. m. to 5 p. m. daily

Bills are due and payable at No. 32 South Eighth St., and must be paid on or before the last discount date to secure discount.

A charge of $2.00 will be made in advance for reconnecting any consumer who has been disconnected for failure to pay his bill before it becomes delinquent.

Failure to receive a statement does not entitle consumer to discount delinquent

Checks must be in office before close of business on last discount day

Save Yourself Annoyance and Delay by Bringing This Statement

Municipal Electric Light and Power Plant

This Bill is Due

Your Last Discount Day is

CITY LIGHT RATE

14 K. W. H. and under will be charged $1.00 minimum

K.W.H.	Gross	Net	K.W.H.	Gross	Net	K.W.H.	Gross	Net
15	$1.05	$1.00	68	$4.49	$4.15	121	$ 7.41	$6.80
16	1.12	1.04	69	4.55	4.20	122	7.46	6.85
17	1.19	1.10	70	4.60	4.25	123	7.52	6.90
18	1.26	1.17	71	4.66	4.30	124	7.57	6.95
19	1.33	1.23	72	4.71	4.35	125	7.63	7.00
20	1.40	1.30	73	4.77	4.40	126	7.68	7.05
21	1.47	1.36	74	4.82	4.45	127	7.74	7.10
22	1.54	1.43	75	4.88	4.50	128	7.79	7.15
23	1.61	1.49	76	4.93	4.55	129	7.85	7.20
24	1.68	1.56	77	4.99	4.60	130	7.90	7.25
25	1.75	1.62	78	5.04	4.65	131	7.96	7.30
26	1.82	1.69	79	5.10	4.70	132	8.01	7.35
27	1.89	1.75	80	5.15	4.75	133	8.07	7.40
28	1.96	1.82	81	5.21	4.80	134	8.12	7.45
29	2.03	1.88	82	5.26	4.85	135	8.18	7.50
30	2.10	1.95	83	5.32	4.90	136	8.23	7.55
31	2.17	2.01	84	5.37	4.95	137	8.29	7.60
32	2.24	2.08	85	5.43	5.00	138	8.34	7.65
33	2.31	2.14	86	5.48	5.05	139	8.40	7.70
34	2.38	2.21	87	5.54	5.10	140	8.45	7.75
35	2.45	2.27	88	5.59	5.15	141	8.51	7.80
36	2.52	2.34	89	5.65	5.20	142	8.56	7.85
37	2.59	2.40	90	5.70	5.25	143	8.62	7.90
38	2.66	2.47	91	5.76	5.30	144	8.67	7.95
39	2.73	2.53	92	5.81	5.35	145	8.73	8.00
40	2.80	2.60	93	5.87	5.40	146	8.78	8.05
41	2.87	2.66	94	5.92	5.45	147	8.84	8.10
42	2.94	2.73	95	5.98	5.50	148	8.89	8.15
43	3.01	2.79	96	6.03	5.55	149	8.95	8.20
44	3.08	2.86	97	6.09	5.60	150	9.00	8.25
45	3.15	2.92	98	6.14	5.65	151	9.06	8.30
46	3.22	2.99	99	6.20	5.70	152	9.11	8.35
47	3.29	3.05	100	6.25	5.75	153	9.17	8.40
48	3.36	3.12	101	6.31	5.80	154	9.22	8.45
49	3.43	3.18	102	6.36	5.85	155	9.28	8.50
50	3.50	3.25	103	6.42	5.90	156	9.33	8.55
51	3.56	3.30	104	6.47	5.95	157	9.39	8.60
52	3.61	3.35	105	6.53	6.00	158	9.44	8.65
53	3.67	3.40	106	6.58	6.05	159	9.50	8.70
54	3.72	3.45	107	6.64	6.10	160	9.55	8.75
55	3.78	3.50	108	6.69	6.15	161	9.61	8.80
56	3.83	3.55	109	6.75	6.20	162	9.66	8.85
57	3.89	3.60	110	6.80	6.25	163	9.72	8.90
58	3.94	3.65	111	6.86	6.30	164	9.77	8.95
59	4.00	3.70	112	6.91	6.35	165	9.83	9.00
60	4.05	3.75	113	6.97	6.40	166	9.88	9.05
61	4.11	3.80	114	7.02	6.45	167	9.94	9.10
62	4.16	3.85	115	7.08	6.50	168	9.99	9.15
63	4.22	3.90	116	7.13	6.55	169	10.05	9.20
64	4.27	3.95	117	7.19	6.60	170	10.10	9.25
65	4.33	4.00	118	7.24	6.65	171	10.16	9.30
66	4.38	4.05	119	7.30	6.70	172	10.21	9.35
67	4.44	4.10	120	7.35	6.75	173	10.27	9.40

SLIP LEFT BY METER READERS SHOWING KILOWATT-HOUR CONSUMPTION WITH SCHEDULE OF GROSS AND NET AMOUNTS

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Hydro-Electric Power Development.—A summary of this discussion of papers presented at the A. I. E. E. spring convention may be found in the report of the convention in the ELECTRICAL WORLD of April 19, 1924.—*Journal of A. I. E. E.*, January, 1925.

Cost of Oil-Engine Power Plants.—Figures are given on two direct-connected Diesel units bought by the Water and Light Department of Carthage, Mo., showing costs around $100 per kilowatt.—*Power*, Jan. 13, 1925.

750-hp. engine:	
Engine delivered at plant	$66,940
Generator	10,500
Oil tanks, foundations, pit erection, changes to building, crane bridge and miscellaneous	15,500
Total	$92,940
1,250-hp. engine:	
Engine and generator cost delivered	104,625
Foundations	5,509
Cooler and muffler pits	758
Erection	2,666
Pumps, crane bridge, changes to building and all miscellaneous, not including oil tanks	4,973
Total	$118,531

Vibration of Steam-Turbine Disks.—J. VON FREUDENREICH.—The increase in power demanded of a single turbine unit and the endeavor to keep the running speed below the critical speed of the shaft have led to the design of thin disks of large diameter, with the consequent danger of disk vibration. In order to determine with accuracy the laws governing this phenomenon, the Brown-Boveri Company carried out a series of tests with the co-operation of Professor Stodola. These are described, the appearance of the apparatus is shown, the mathematical reasoning underlying Stodola's method of calculating the natural frequencies is given, and the computed frequencies are compared with those found by experiment. The close agreement for both the condition of rest and of rotation makes it appear that disks may now be designed which will be quite free from vibration under all working conditions.—*Engineering (England)*, Jan. 2 and 9, 1925.

Generation, Control, Switching and Protection

Short-Circuit Protection.—J. LE-BIDOIS.—The underground cable network of a 30,000-kw., 5,250-volt city central station is used as an example to show how feeders and substations have to be dimensioned to keep the short-circuit current within permissible limits. With given generators, cables and transformers, the entire problem is, of course, a matter of properly distributed and proportioned resistance and reactance. In very simple mathematical terms the author indicates how much and for how long a time a certain cable cross-section can be overloaded before dangerous heat is reached. Having determined this limit, the next step is to calculate the amount of reactance which each feeder must have to limit the available short-circuit energy to the maximum value. A further step is the adjustment of relays so as to insure the opening of breakers after the calculated maximum time lapse. Though all the calculations pertain to the chosen concrete example, alignment charts and curves are given from which results for any other given data can readily be determined.—*Revue Générale de l'Electricité*, Jan. 3, 1925.

Operating Diesel Engine in Combination with a Steam Plant.—J. W. CROW.—Oil and fuel consumption are given for each of five months for a plant in which a 1,250-hp., two-cycle engine was operated 90 to 95 per cent of the time, with a steam unit to assist in carrying the daily peaks and to take the load when the Diesel unit was shut down for inspection or repairs. The total operating cost is from 1.18 cents to 1.59 cents per kilowatt-hour; when steam alone was used it averaged 2.18 cents for the year.—*Power*, Jan. 27, 1925.

Transmission, Substations and Distribution

Pole and Cabin Type Transformer Stations.—K. KESL and P. CHARPENTIER.—For the supply of rural communities along a high-tension trunk line the erection of outdoor transformers on poles is customary. Such structures must not only serve as dead-end towers for the feeding lines but at the same time must support the weight of the transformer. Very simple formulas based on and corrected for actual experience are given by means of which the strength of such poles for various wire tensions, transformer weights and pole shapes can readily be calculated. For larger capacities the transformer is usually placed in an inclosed cabin or kiosk which terminates in a steel tower. In this case particular care has to be taken to provide sufficient ventilation to prevent overheating of the transformer. For given losses the air volume required can be calculated from given formulas with sufficient practical approximation. If natural draft is not adequate to supply the required air volume, a blower must be installed the capacity of which is found with another formula derived from experience. For transformer stations involving several thousand kva. the authors suggest the installation of two blower sets which will operate under thermostatic control, depending upon the prevailing load. Below 40 deg. oil temperature the blowers will stand still. Between 40 deg. and 60 deg. the two will run electrically in series. Between 60 deg. and 100 deg. parallel operation of the blower sets will be maintained.—*Revue Générale de l'Electricité*, Jan. 24, 1925.

Three-Wire Direct-Current Distribution Networks.—HERBERT W. TAYLOR.—The permissible loading of underground cables depends not only on the heat conductivity of the soil but on several other factors difficult to evaluate. Cables laid directly in the earth are more effectively cooled than those in ducts, and those with a single core are better than those of the three-core type, whereas the rating of a triple-concentric cable with the same cross-section is the lowest of all, being limited by the temperature of the hot inner conductor. These considerations, and others dealing with the economics and operation of networks, are discussed in an abstract of an I. E. E. paper. Average conditions of current loading are given in the accompanying table. To the American reader, accustomed to 110/220-volt systems with well-grounded neutrals, the suggestion to avoid operating troubles due to a ground on one "outer" of a 240/480-volt system by using sufficiently light fuses in the ground connection of the neutral comes as a surprise, though this is permissible under English rules, which allow temporary operation with one side at full line voltage to ground.—*Engineering (England)*, Jan. 16, 1925.

MAXIMUM PERMISSIBLE CONSTANT-CURRENT LOADING*

Area of Live Conductors (Neutral Core Half the Size of Outers) Sq.In.	Cables Laid Direct (Lead-Covered and Armored)			Cables Drawn in (Plain or Lead-Covered).		Cables Laid Solid (Vulcanized-Bitumen)	
	Three Single-Core Cables Amp.	Three-Core Cable Amp.	Triple-Concentric Cable Amp.	Three Single-Core Cables Amp.	Three-Core Cable Amp.	Triple-Concentric Cable Amp.	
0.10	298	263	249	202	185	162	
0.15	367	331	313	261	238	208	
0.2	438	390	371	317	290	254	
0.25	497	447	421	373	338	295	
0.3	559	501	478	428	388	340	
0.4	665	589	562	526	474	415	
0.5	748	669	641	604	545	482	
0.6	845	...	724	696	...	552	
0.75	949	...	812	800	...	634	
1.0	1,158	...	997	1,012	...	800	

*The values given are for sandy loam with 10 per cent moisture content, and clay with 20 per cent moisture content.

Units, Measurements and Instruments

Measuring of Noises.—K. LUBOWSKY.—Machines of purely mechanical nature, and in particular electrical machines, transformers and apparatus, produce during their normal operation certain noises the magnitude and acoustic nature of which vary greatly. It is frequently desirable to have some means of measuring the volume of a certain noise, eliminating, however, as much as possible the human element. The author gives in this article two methods of achieving this, the first a semi-objective, the second a totally objective method. In the first method a microphone is placed at a certain distance from the noise center and a 16-volt dry-cell battery circulates a current through this transmitter and a small telephone transformer. A standard receiver of high resistance is connected to the secondary of this transformer. A resistor with a large number of fine steps is in parallel to the receiver. A relative measurement of the noise is obtained by the amount of resistance which has to be shunted across the telephone to silence it. The observer with the telephone has to be, of course, in a sound-proof booth or out

of the sphere of the noise. In the second method the current from the microphone is first amplified through a vacuum tube and the amplified current is then rectified in an audion into direct current, which can be readily and accurately measured in a moving-coil instrument. Ten actual tests on transformer laminations and motors with such an arrangement are described in detail.—*Zeitschrift des Vereines Deutscher Ingenieure*, Jan. 24, 1925.

Testing Apparatus for Switch Parts.—O. EDELMANN.—The German national electrical testing laboratories have developed special apparatus for electrical and mechanical testing of various marketed articles. In the present paper machines are described with which parts of knife switches can be subjected to tests imitating actual service. The bridge of insulating material which holds the two knives of a double-pole switch has to withstand torsional stress, the handle of the switch imposing a bending stress. Consequently, special testing machines have been made which subject these parts to analogous forces. To insure the reliability of such switches also in hot engine rooms or the tropics, these testing machines are equipped with electric or gas heating arrangements, to permit simultaneous mechanical and thermal testing. The hardness of the insulating material can be determined readily with a modified Brinell ball press.—*Elektrotechnische Zeitschrift*, Jan. 29, 1925.

Use of An Oscillograph in Mechanical Measurements.—HARVEY L. CURTIS.—By causing mechanical phenomena to affect an electric current measurements can be made of motions which involve exceedingly short time intervals. Examples are the sequence of events in the firing of a gun, the recoil of a gun-carriage, the torsional vibration of a shaft and the rise of pressure in a bomb. For such uses as these certain modifications were made in the usual form of oscillograph, e.g., a change in the shutter mechanism making it possible to see the light on the viewing screen except during the brief periods when the shutter is opened to admit light to the film; installing a tuning fork and optical system for recording timing lines which extend entirely across the film at intervals of 0.001 second, etc. Measurements of velocity, for example, can then be made by getting a record of the time of opening or closing of electrical contacts spaced at known distances. From such data displacement, velocity and acceleration curves can be drawn. The author describes the devices and circuits used and shows results obtained. There are numerous illustrations.—*Journal of A. I. E. E.*, January, 1925.

Motors and Control

Synchronized Asynchronous Motors.—J. BELLAIGUE.—A French concern has recently installed what are, it is asserted, the largest motor-generator sets using a special synchronized asynchronous motor. The sets are each rated at 2,250 kw. and change 12,300-volt, 50-cycle, two-phase current into 520-volt direct current. The sets comprise one motor, one generator and the exciter on one shaft, running at 360 r.p.m. to 428 r.p.m., depending upon the fluctuating frequency. The motors have an unusually large air gap between stator and rotor, which is mechanically of great advantage. Open slots in the punchings permit form-wound coils. By a simple rheostat change on the exciter the power factor of the motor can be regulated between 0.98 lagging and 0.98 leading. The start of these units requires two and one-half minutes. At full load and unity power factor 90 per cent over-all efficiency has been obtained.—*Revue Générale de l'Electricité*, Jan. 10, 1925.

Self-Excited Synchronous Induction Motor.—An abstract of this discussion on a paper presented at the A. I. E. E. spring convention may be found in the ELECTRICAL WORLD report of the convention—April 19, 1924.—*Journal of A. I. E. E.*, January, 1925.

Heat Applications and Material Handling

Electric Vehicles.—D. E. BATTY.—The author deals in a broad way, from a technical and economic aspect, with the use of electrical energy for propelling, directly or indirectly, road vehicles. He covers the general technical characteristics, the trolley bus, gasoline electric systems and other electric torque converters, battery vehicle and finally the general economic field. This paper was presented before the Institute of Automobile Engineers in England and is abstracted at length in this issue.—*Electric Vehicle*, January, 1925.

Ash Handling for Steam Power Stations.—A. HOSSACK.—The author describes a new system of ash handling which has been installed successfully at the Rand Power Company's generating station at Vereeniging. A thorough investigation was made as to the relative merits of all known systems, and in the one finally selected the ashes are fed continuously from the back drum of the grate through a chute into a trough filled with water and running the entire length of the boiler plant. The ashes are conveyed along the length of the trough by means of a drag link conveyor. A very comprehensive account is given of the entire system with diagrams of the layout.—*Journal of South African Institution of Engineers*, January, 1925.

Electrophysics, Electrochemistry and Batteries

Directions for the Study of Non-Ignitable and Self-Extinguishing Boards and Moldings for Electrical Purposes.—This is a report (Ref. A/S 10) of the British Electrical and Allied Industries Research Association. The materials in question are defined and classified. Specifications are given for mechanical and electrical tests. Under the former are included tensile, compression and shearing strength, brittleness, stiffness or rigidity, shrinkage, warping or swelling, machining properties, effect of oil and absorption of water. Electrical tests include determination of a time-voltage curve for puncture, surface breakdown voltage fuse test (involving repeated subjection, until failure, to the blowing of a copper fuse clamped between two flat pieces of the specimen), and finally an arc test. Provision is made also for radiant heat, ignition and aging tests.—*Journal of I. E. E.* (*England*), December, 1924.

Manufacturing Carbon Black by Electrical Process.—J. J. JAKOSKY.—The possibility of manufacturing carbon black from oils by an electrical process which possesses advantages over present methods is indicated. In the course of investigations of the effects of high-voltage electrical discharges on hydro-carbons it was noted by the Bureau of Mines that under certain conditions natural gas could be decomposed and carbon black produced. These effects have been studied in order that the fundamental factors in the reactions may be ascertained.—*Technical Paper No. 35 of the Bureau of Mines.*

Telegraphy, Telephony, Radio and Signals

Behavior of the Triode Valve Under the Influence of a Magnetic Field.—H. NUKIYAMA and S. KITTA.—The triode valve in which the filament and the plate constitute coaxial cylinders was chosen and the magnetic force parallel to the filament was applied. It was found that the static characteristics were greatly modified. The grid current becomes a maximum when the magnetic force is intermediate between the critical magnetic forces for the grid and the plate. The theoretical explanation and an example of application of the phenomena are given.—*Journal of Institute of Electrical Engineers of Japan*, No. 436.

Burglar Alarm for Bank Vaults.—W. BLUT.—The basic principle of this alarm system is a Wheatstone-bridge arrangement, in two branches of which are placed detecting elements sensitive to the slightest motion, heat or break in the circuits. Two four-cell storage batteries supply the operating current. In the diagonal branch of the bridge is placed a sensitive polarized relay which acts as contactor for secondary alarm apparatus. A pilot lamp indicates at all times the perfect balance of the system and serves at the same time as a signal that everything is in proper order.—*Elektrotechnische Zeitschrift*, Jan. 29, 1925.

Miscellaneous

Directions for the Study of Unvarnished Textile Fabrics (Including Cloth, Webbing and Yarn).—This is a report (Ref. A/S 11) of the British Electrical and Allied Industries Research Association. Features to be considered in the examination of materials are pointed out. Terms applying to cotton, flax (linen) and silk fabrics are defined. Apparatus for testing fabrics is described and specifications are given for conducting the tests. The appendix contains information respecting raw materials and processes employed in the manufacture of fabrics—e.g., fineness, quality, color and staple length of cotton, classes and sources of flax and silk, and a classified list of sizing materials.—*Journal of I. E. E.* (*England*), January, 1925.

News of the Industry

Conowingo License Soon

Will Probably Be Issued Next Week by Federal Commission—Obstacles to Plant Disappearing

FINAL sanction of the fifty-two-million-dollar hydro-electric project of the Susquehanna Power Company at Conowingo, Md., by the Federal Power Commission will in all probability be given next week. This is made clear by O. C. Miller, executive secretary of the commission, in a press statement wherein he says that reservations in contracts between companies involved in the project, which provide for state or federal regulation of all charges between the companies, as revealed in applications just filed with the Pennsylvania Public Service Commission in Harrisburg, Pa., have placed the entire undertaking on the most favorable plane possible for future regulation in the interest of consumers. Mr. Merrill is anxious that the Pennsylvania and Maryland state commissions shall act concurrently with the Federal Power Commission. Delay by the state commissions, however, will not prevent the Federal commission from issuing the license.

"Under the petition which came before the Maryland commission a few weeks ago," Mr. Merrill explained, "contracts between the companies provided for fixed charges. We did not want to be put in a position of approving these contracts only to find them excessive in years to come and ourselves deprived of power to revise them. Our request that this be changed was agreed to readily by counsel for the companies."

In applications filed on Wednesday in Pennsylvania and Maryland the company asked approval of contracts for a yearly rental of $4,030,000 to be paid by the Susquehanna Electric Company to the Susquehanna Power Company for use of the power plant; for annual rental of $275,000 to be paid the Philadelphia Power Company by the Susquehanna Power Company for use of the Pennsylvania pool, and for a minimum annual payment of $550,000 by the Philadelphia Electric Company to the Susquehanna Electric Company for energy sold at the state line.

"These contracts are subject to regulation by the Maryland Public Service Commission, the Pennsylvania Public Service Commission and the Federal Power Commission within their respective jurisdictions," the amended petitions read.

"As for jurisdiction," Mr. Merrill continued, "Maryland's Attorney-General and its commission and Pennsylvania's Attorney-General and its commission are convinced they can regulate adequately the sale of power within their own states. In interstate shipments of power, as provided in the contract between the Maryland company and the Philadelphia company, the Federal Power Commission has jurisdiction under present legislation. The same thing is true of the exportation of power from Maryland to Pennsylvania and reshipment back to Maryland. The Federal commission can regulate the sale from the generating company to the ultimate consumer."

The petitions have revealed that the proposed dam will have a crest elevation of between 100 ft. and 110 ft. This provides for a future agreement between the Conowingo companies and the Pennsylvania Water & Power Company at McCall's Ferry, Pa., and will enable the Pennsylvania plant to elevate its dam and eliminate present obstructions in its tailrace. An interchange of power could be arranged in that event between the two companies.

Governor Pinchot's program for the supervision of Giant Power development will embrace the Conowingo project as it affects Pennsylvania, regardless of present conditions, the Governor has announced.

A tentative agreement between the city of Baltimore and the Susquehanna Power Company, conserving the city's water rights in the river, has been reached and awaits ratification by the Philadelphia interests.

A temporary injunction against occupation of a 90-acre tract forming part of the reservoir site has been issued by the United States District Court in Maryland at the instance of a property owner.

Muscle Shoals Bill Again in Jeopardy

Sent Back to Conference on the Ruling of Senate President that It Contains New Matter—Dilatory Tactics May Bring About Its Final Death

ONCE more the Muscle Shoals bill, which has taken up so much of the time of the short session of Congress, has been put in serious jeopardy. This is the result of Senator Norris' objection to the conference committee report, on the ground that the bill as amended contains matter not in either the Senate or the House bill. Senator Cummins of Iowa, President pro tem. of the Senate, sustained Senator Norris' point of order, and an appeal from his decision was defeated by forty-five to forty-one. Thereupon, on February 23, the bill was sent back to conference by formal action in the Senate. It is understood that the conferees are unwilling to agree to the Underwood bill in the exact form in which it passed the Upper House. Any effort that they may make to perfect the measure carries with it the possibility of another point of order against it. In such an event the time is thought to be too short to permit of the passage of the bill before the end of the session on March 4. As this is written, it is said to be the intention of the conferees to alter the bill and report it promptly to the Senate.

When the conference report on the Muscle Shoals bill came before the Senate, Senator Norris immediately made the point of order, alleging that the conferees were attempting to legislate by means of a conference report, procedure prohibited by the rules of the Senate. The presiding officer on the following day sustained the point of order made by the Nebraska Senator. Senator Underwood appealed from the decision of the chair. This resulted in protracted debate as to the parliamentary situation involved, but finally the chair was sustained. In response to a question by Senator Underwood, the presiding officer held that the bill must be referred to the same conferees as had previously reported on it.

Dayton Central Station Goes to Columbia Gas & Electric

Announcement that the Columbia Gas & Electric Company, a holding concern that, with offices in Charleston, W. Va., and New York City, controls the Union Gas & Electric Company of Cincinnati and other light and power, traction and gas utilities, has acquired the Dayton Power & Light Company has just been made. This constitutes an important step in the centralization of the electric light, power and gas facilities throughout the large industrial district in the Miami Valley from Cincinnati north through Dayton to Piqua, Ohio. Control will be confirmed largely through an exchange of securities.

Negotiations have been in progress for some time, according to Philip P. Gossler, president of the Columbia Gas & Electric Company, who said: "By this step the huge natural-gas resources of the Columbia Gas system, its present power facilities and those of the Dayton Power & Light Company will be unified and insure the industrial territory served a greatly strengthened public utility to meet the demands for power, electric light and natural gas for industrial purposes."

The Dayton Power & Light Company supplies a large part of the Miami Vallay, operating in twelve counties and serving more than ninety cities, towns and villages, including Piqua and Xenia. Its lines are connected with those of the Cincinnati and other generating stations. The grouped properties will have a generating capacity of 434,000 hp.

Hetch Hetchy Seeks Market

Private Companies May Act as San Francisco's Agents—Scheme to Sell to Los Angeles

A WAY for temporary disposal of Hetch Hetchy power opened when the Board of Supervisors of San Francisco on February 24 passed by a vote of ten to seven a resolution allowing the city to dispose of its power through local private distribution systems. The resolution specifically prohibits the sale of Hetch Hetchy power to the private corporations for resale. This action is interpreted to mean that the two power companies will be asked to act as the city's agents for the retailing of the power on a mutually satisfactory basis to be worked out at subsequent conferences of all interested. Such a plan of disposal was adopted to avoid violating the terms of the Raker act, the Congressional legislation granting the Hetch Hetchy water rights to San Francisco, which, it is claimed, prohibits the sale of electrical energy to any private corporation for resale.

Two of the important provisions of the resolution were that the Railroad Commission be requested to expedite evaluations of the distribution systems of the Pacific Gas & Electric Company and the Great Western Power Company and that immediately following the evaluation report proceedings be begun to create a city bonded indebtedness to raise funds wherewith to purchase one or both of the distribution systems. The intent of the resolution is to obtain some revenue from the 70,000-kw. power plant which will be ready to go into operation April 1 until such time as the people of San Francisco decide what eventually shall be done with Hetch Hetchy power. One plan advanced by some San Francisco officials involves carrying Hetch Hetchy power to Los Angeles for sale to that city. According to this scheme, the lines of the San Joaquin Light & Power Company and the Southern California Edison Company would be used to convey the energy, compulsory legislation being sought if necessary to bring this about. San Francisco would, under this rather improbable scheme, build a line from the Hetch Hetchy system to Merced to connect with the San Joaquin lines.

A temporary injunction has been issued preventing the Board of Supervisors from purchasing steel towers to complete the Moccasin Creek transmission line from the Newark substation to San Francisco. This injunction was sought by a member of the board and other taxpayers.

Governor Ritchie Opposes Public Ownership

There is only one alternative to the public control of privately owned public utilities, and that is state ownership, Governor Ritchie told members of the Maryland Utilities Association at its third annual convention in Baltimore, on Tuesday, February 24, which was attended by about two hundred delegates, representing twenty-four utility companies. "I never have seen any evidence that public ownership is half so desirable as private ownership regulated and controlled by the state," he said.

The Governor spoke at the luncheon. At the morning session an address was made by Emory L. Coblentz, president of the association; W. B. Pierce of the General Electric Company told of the use of electricity in cooking, and "Fuel Burning" was discussed by Prof. A. G. Christie of Johns Hopkins University and G. W. Gail, consulting engineer. In the afternoon H. A. Brooks, commercial manager of the Potomac Electric Power Company, spoke on the rural extension of light and power service.

Charles M. Cohn, vice-president of the Consolidated Gas, Electric Light & Power Company, was toastmaster at the annual dinner. L. Irving Pollitt, president Southern Gas & Electric Corporation, spoke on hydro-electricity.

Merger of Fitkin Plants in New Jersey Under Way

Application has been filed with the New Jersey Board of Public Utility Commissioners by five electric, one water and seven gas companies managed by the General Engineering & Management Corporation of New York, which is associated with the A. E. Fitkin interests, for permission to merge into one operating company. The electric light and power companies concerned are the Central Power & Light Company, of which Abram E. Fitkin is president, which would become the absorbing company; the Central Jersey Power & Light Company of Morristown, the Tri-County Electric Company of Pompton Lakes, the Lakewood & Coast Electric Company and the Toms River Electric Company.

C., M. & St. P. Electrification Saves Big Sum

Net Economy of $12,400,000 Since 1916, or Nearly 80 per Cent of Total Cost of the Change from Steam to Electric Power

AN ANALYSIS of the comparative costs of steam and electric operation has been completed by the Chicago, Milwaukee & St. Paul Railway Company and has been issued in a report by H. E. Byram, the road's president. This investigation covers the Rocky Mountain, Missoula and Coast divisions, comprising 648 miles of first main-line track and 200 miles of other trackage. It was undertaken to determine the economic results of the change from steam to electric operation on this extensive development, where all the train movements, freight, passenger, switching, etc., are performed exclusively by electric power.

The report shows an actual saving of $12,400,007 in favor of electric operation. This includes the total saving made since the first division was put into electric service in April, 1916, and includes the figures through the year 1924. The net savings shown are obtained by deducting the interest and depreciation charges for the additional investment required by electrification from the savings made in operating expenses. The total cost of the electrification was $15,625,739. The saving made to date is therefore within $3,225,732 of this amount.

Work Commenced in 1914

Electrification of its Western lines was commenced by the St. Paul road on the Rocky Mountain division in 1914. Direct-current 3,000-volt overhead trolley construction was used. Energy is purchased by the railroad company at taps in its high-tension lines and is transmitted to substations, where it is stepped down from three-phase alternating current at 100,000 volts to 2,300 volts. It is then converted by motor-generators to 3,000 volts direct current for distribution on the trolley. The locomotive motors are constructed to act as generators when descending grades, thus returning energy to the line and controlling the speed of trains without excessive use of mechanical brakes.

In making the comparison of costs the figures for electric operation are based on the actual cost for the year 1923. The figures for steam operating costs are the actual costs for the last twelve months of such operation, adjusted to the price levels of 1923. Adjustments were also made to compensate for changes in traffic and operating conditions between the period of steam operation and the year 1923.

Figures used in making the comparison include only the operating expenses and the carrying charges on the investment in property directly affected by the change in power. Costs common to both electric and steam operation are excluded.

No Indirect Savings Credited

No savings were credited to electric operation which were not directly ascertainable, as, for example, the possible increased revenue due to the release of equipment used in the transportation of coal under steam operation. Similarly, no credit was given electric operation for the better utilization of freight equipment due to faster movement, less wear and tear on road and equipment, reduced station expense and similar expenses affected by the number of trains required to handle a given tonnage. In the case of all of these items it was impossible to determine an exact monetary value for these incidental advantages. In the same way, no credit was given for the increase in passenger revenue resulting from the attractiveness and greater comfort of travel under electrified operation.

Costs of electric power were based upon a minimum total payment corresponding to the respective number of kilowatts for which the railway company has exercised option in 1923 in each of the respective sections of the line. Where this amount of power was not sufficient to handle the increased traffic, the power cost was increased on the basis of the additional number of kilowatts required.

Wisconsin Electrical Inspectors Discuss Code

The importance of education, diplomacy and publicity in the effective execution of the electrical inspector's duties was given much attention at the annual meeting of the Wisconsin Chapter of Electrical Inspectors, held in Milwaukee, February 17-19. The chapter's committee on education is doing much to help the members fit themselves for any problems that may arise and to enable them to lend constructive aid to the electrical contractors and the public.

In an address on "The Code, the Inspector, the Executive," Frank Frey, Jr., Geuder, Paeschke & Frey Company, defended the code as a guide to best practice based on experience. Inspectors by intelligent application of the code to a given job may help the contractor to improve his next installation. In dealing with executives of manufacturing concerns inspectors will obtain co-operation and better results if diplomacy and tact are used in convincing the executive of the advantages of compliance with the code, rather than trying to coerce him through fear of penalties.

The merits of state licensing were discussed by C. W. Babcock, assistant city attorney of Milwaukee. The Milwaukee ordinance is now before the United States Supreme Court and provides for the licensing of electrical contractors who employ a supervisor of five years' experience. The advantages of uniform inspection ordinances for all communities of the state were emphasized.

Effective and practicable forms of publicity for electrical inspectors were described by W. S. Boyd, secretary Western Association of Electrical Inspectors. Use of the daily and weekly press was urged as a means of telling the public of the motives and organizations behind the electrical code. Sections of the code applying to fire and safety are more effectively explained by emphasis on the convenience, comfort and economy resulting from compliance. Interesting methods used by various inspectors for impressing the importance of sealed main fuses were reported by Mr. Boyd. The sealed main fuse was urged as the best protection against the two greatest hazards of electric wiring—looping or kinking of wires and "doctoring" of fuses.

The wiring methods committee urged the importance of considering all wires as bare. Pressed-steel fittings were condemned for damp places. Galvanized conduit was called superior to black pipe because of its greater resistance to corrosion and better conductivity at joints. The use of approved anchors instead of wooden plugs was urged for fastening conduit to masonry walls.

Compliance with the maximum regulations of states such as Wisconsin was suggested as a means of enabling manufacturers to have their products accepted elsewhere. The success of these maximum regulations would, it was maintained, ultimately raise the requirements in other localities.

Addresses were also made by George A. Shaughnessy, municipal court judge, and by Dr. T. C. Cornell on "Electrical Therapeutics." An inspection tour was made of the Lakeside power plant.

Officers elected for 1925 were: president, Raymond Schleck, South Milwaukee; vice-president, Pearl S. Bixby, Oshkosh; secretary, A. C. Schultz, Milwaukee.

Governor Trumbull for Uniform Code Interpretation

Gov. J. H. Trumbull of Connecticut addressed the newly formed Eastern Association of Electrical Inspectors at Hartford Monday upon the advantages of uniform wiring code interpretation and emphasized the economic waste of multiplex ordinances in this field. F. E. Cabot, secretary Boston Board of Fire Underwriters, recommended the establishment of a quasi-court for national code interpretation. R. M. Hudson of the Department of Commerce, Washington, outlined the economic benefits of simplification and called attention to the need of greater standardization of attachment plugs. He favored uniform wiring regulations. C. A. Bates, electrical engineer Bryant Electric Company, Bridgeport, spoke on the value of a single wiring code from the manufacturer's standpoint, and A. R. Small, vice-president Underwriters' Laboratories, New York, emphasized the importance of an adequate factor of safety in wiring code applications, describing the "set-up" under which future code revisions will be made in co-ordination with the work of the American Engineering Standards Committee and affiliated bodies.

At the opening session the former Western New England Association of Electrical Inspectors was merged in the Eastern association and the following officers were elected: President, Thomas H. Day, Hartford; vice-president, W. C. Field, Springfield, Mass.; secretary pro tem., E. J. Balf, Hartford; treasurer, Allen W. Hopkins, Springfield. At this session President Day was presented with a gold watch.

American Gas & Electric Growth

Completion of First Units of Philo and Twin Branch Plants Marks an Important Advance—132,000-Volt Transmission from Lake Michigan to Southwestern Virginia

AN IMPORTANT step taken in the growth of the electric light and power systems controlled by the American Gas & Electric Company of New York was marked recently when the company's new steam plant at Philo, near Zanesville, Ohio, went into commission. This plant, operated by the Ohio Power Company, and the Twin Branch plant now under construction at Mishawaka, Ind., for the Twin Branch Power Company, are identical in size and equipment and will be among the most modern and efficient in the country. They are each designed for an ultimate capacity of 240,000 kw., with 80,000 kw. at present installed in two 40,000-kw. units. The boiler capacity per 40,000-kw. unit consists of three 1,400-hp. boilers and one 500-hp. reheat boiler. The projected plant of the Scranton Electric Company, another American Gas & Electric subsidiary, will follow the same design.

The completion of the first units of the Philo and Twin Branch plants coincides with the development of the American Gas & Electric Company's continuous system of high-tension transmission lines between Lake Michigan and western Virginia. Sections of transmission line between Crooksville, Ohio, and Huntington and Charleston, W. Va., and between Bluefields, W. Va., and Roanoke and Lynchburg, Va., are now under construction and will be completed during the summer and fall. Upon the completion of a proposed line between Logan, W. Va., and the Appalachian Power system and the raising of a section of line between Fremont and Fostoria, Ohio, from 66,000 volts to

GROWING TRANSMISSION SYSTEM OF AMERICAN GAS & ELECTRIC COMPANY

132,000 volts the system will be complete with a standard voltage of 132,000 generated in large and economical steam plants.

The merger of the American Gas & Electric Company and the Appalachian Securities Corporation, noted in the ELECTRICAL WORLD of February 21, brought to the American Gas & Electric control not only of the Virginian Power Company of Charleston, W. Va., formerly operated by Henry L. Doherty & Company, but also of the Appalachian Power Company of Bluefield, W. Va. These two companies operate in a large mining territory in central and southern West Virginia and in Virginia and fit naturally into the American Gas & Electric system. With the Virginian Power Company went control of the Portsmouth (Ohio) Public Service Company and the Kanawha Valley Power Company of South Charleston.

M. J. Hennessey, manager of the Appalachian Power Company, has confirmed the report that the corporation will also extend its power lines from Roanoke, Va., through Martinsville to Danville and thence to the state line. Surveying is now in progress, he said, and rights-of-way secured, though it will be at least three months before actual construction can be started. While no statement to that effect was made, the fact that the line will go to the North Carolina border leads to the assumption that a connection with the Carolina Power Company's lines in North Carolina, and thus with the systems of the Georgia, Tennessee and Alabama power companies, will be made, constituting a further step in Southern interconnection.

Robert Says That $50,000,000 Is Ready for Carillon

Announcement was made in Montreal this week that the $50,000,000 required for the Carillon electric development scheme on the Ottawa River is available in New York. The announcement came from E. A. Robert, president of the company which was organized to build and operate the plant. The scheme calls for the development of 300,000 hp. at Carillon, which is about 10 miles below Hawkesburg. In his statement Mr. Robert said: "As far as the financing is concerned, everything is now ready for an immediate start on the work of construction. Furthermore, I may say that all the preliminary work has been done by the engineers and plans have been prepared."

The above report from Montreal was denied by bankers in New York, who said the financing of the Carillon project was still *in statu quo*. The hitch, it was stated, is a Canadian ruling prohibiting the grant of a permit for foreign service for more than one year. This objection must be overcome before anything can be done by the promoters of the scheme. Objections from Canadian industrial interests have been so strong that it is not believed that any step can be taken now toward constructing the plant. Interested bankers state, however, that this does not mean permanent abandonment of the scheme.

Politics and the Utilities

Pending or Proposed Legislation in Indiana, California, Utah and Oklahoma

A BILL to abolish the Indiana Public Service Commission, now made up of five commissioners, and to create in its place the Indiana Utility Commission, to be made up of three members, appointed by the Governor, has been introduced in the Indiana Senate and referred to the judiciary committee. It will probably stir up strife, as it is alleged to be aimed at two members of the present commission who are said to be unpopular with utility companies. The bill is defended on the score of economy.

State taxation of publicly owned utilities supplying light, power, heat and transportation is the purpose of constitutional amendments introduced in the California Legislature by Senator F. J. Power of Modoc County and Assemblyman S. C. Hartranft of Orange County. The publicly owned utilities would be taxed on a gross receipts basis, as are privately owned ones.

A bill providing for the repeal of the law creating the Public Utilities Commission of Utah has been killed by unanimous vote of the members of the House of Representatives of that state. The bill was referred to the committee on public utilities and reported out with the recommendation that the enacting clause be striken out.

At hearings held in Oklahoma on the revocable permit measure, arguments were made in favor of the bill by executives and attorneys of public service corporations, and determined opposition was offered by certain members of the Oklahoma Municipal League. In response to a letter sent out by the acting secretary of the league requesting such action, attorneys or mayors of thirty-three cities and towns sent telegrams to the Senate committee in charge of the bill, thirty of these opposing the bill and three favoring it.

A joint resolution introduced in the Oklahoma Legislature provides that all public service corporations in the state shall be required to complete appraisement of all physical property controlled and belonging to them at the close of the fiscal year ending June 30, 1925, and each two years thereafter, and report to the Corporation Commission. Failure to comply with this requirement is punishable by a heavy fine.

Law Proposed to Facilitate Use of Barge Canal Power

Completely ignoring the Democratic program for development and control of state-owned water power introduced in the Legislature at Albany last week, the State Engineer and Surveyor, after conference with the Superintendent of Public Works, has had a bill introduced in the Senate to permit the sale to the highest bidder of the electrical energy generated at the state's hydro-electric plant on the canalized Mohawk River at Crescent Dam and Vischer Ferry. Legislation passed in 1923 permitted the sale of this energy only to municipalities, and the recent conference of the mayors of the cities in the capital district (noted in the ELECTRICAL WORLD for January 31, page 265) brought out the fact that none of the municipalities was in position to take any considerable portion of it. Under the law now proposed, generally speaking, the energy may be sold to the highest bidder, whether that bidder be a corporation, a private business or a municipality.

Renewal of Franchise in Denver Up for Action

Definite decision was announced by officials of the Public Service Company of Colorado on Wednesday to apply for the renewal of its present franchise in Denver at the regular city election, May 18, rather than postpone the action until May of next year, when the present twenty-year franchise terminates. The directors of the company have placed a resolution embodying their plans in the hands of the City Council. Favorable consideration is anticipated which will permit of a referendum to voters, although it is understood that the city desires to appoint an expert to make valuation of company property before an official answer is announced.

Hearing on Holyoke Invasion Case Concluded

Hearing by the Massachusetts Department of Public Utilities on the Turners Falls Power & Electric Company's petition for leave to enter Holyoke, Mass., for the purpose of energizing the Holyoke Street Railway Company's lines, of which the opening was reported in the ELECTRICAL WORLD for February 14, page 369, was concluded on February 21.

On the resumption of the hearing testimony was given to controvert the contention that ways of entrance are open other than the proposed lines across territory of the Holyoke Water Power Company. Heavy construction expense was given as a strong objection to alternative routes.

Attention was given to a statement that the price paid for the railway's obsolete power plant indicated a purpose to invade the general power field in Holyoke. George W. Lawrence, president of the Turners Falls company, testified that his company was not seeking other business in the city than that of the street railway. He said the purchase price of $400,000 was the figure at which the property was carried on the books of the street-railway company, less depreciation.

Lewis D. Pellissier, president of the street-railway company, testified that the contract with the Turners Falls company is more advantageous by $30,896 a year than that proposed by the Holyoke Water Power Company and means a saving of $50,000 over what it would cost the street-railway company to generate its own power.

John F. Shea, representing the municipal electric plant, said: "We in Holyoke feel that competition with the Holyoke Water Power Company is limited by legislative enactment and that this would not be the case with the Turners Falls company."

More About Heaviside

Professor E. J. Berg Throws Additional Light on Britain's Great Electrical Scientist

THE unusual character of Oliver Heaviside, tributes to whom by Sir Oliver Lodge and B. A. Behrend were last week published in the ELECTRICAL WORLD, and the more or less apochryphal character of some of the things that have been published about him both before his recent death and since lend unusual interest to personal reminiscences from the few who really knew him. Among these few is Prof. Ernest J. Berg of Union College, Schenectady, N. Y., who, at the request of the ELECTRICAL WORLD, put in written form the appreciation of Britain's great electrical scientist which follows:

"The recent death of Oliver Heaviside was a shock to his friends and a serious loss to the world. Almost within a year the electrical engineering profession has lost two of its greatest benefactors—Charles P. Steinmetz in this country and Oliver Heaviside in England. In many ways they were similar and yet also very different. Both were thinkers of extreme originality; both left a fine heritage in books and papers; both gave to the world unstintingly and unselfishly the best that they had. Both had a similar philosophy of education—as a trival coincidence they had remarkably similar handwriting. Each appreciated the other. Only a short time ago Heaviside told me that America lost its greatest engineer in the death of Steinmetz. Both had decidedly artistic temperaments. Heaviside, more extreme in every way, could not bear to see anything that was not artistically correct, whether in the relation between the type and paper used in printing a book or the method employed by his neighbors in trimming trees. The walls of his study were covered with prints of famous men—philosophers, ancient and modern, painters, musicians and scientists—but the most precious ornament was a beautiful oil painting made by his father. Like Steinmetz, Heaviside greatly appreciated youthful beauty, and he once insisted upon giving the writer some pictures of a young girl—pictures that had always inspired him.

NOT YET APPRECIATED

"But the lives of the two men were very different. Steinmetz met with appreciation and recognition from his early schooldays, whereas Heaviside can hardly be said to be appreciated as yet. Heaviside had to fight every inch of his way—fight against great odds—and he found great difficulty in getting his writings printed and brought before the public. His scientific works will yet have their day. They are often difficult to read, but even a non-mathematician should enjoy them. They are extremely interesting human documents—full of enthusiasm and full of bitterness. Yet Heaviside himself seemed to have no bitterness in his soul; he was, indeed, kindness and generosity itself. Once inside his front door—and certainly it was difficult to get there—you were his friend, and with friends he enjoyed discussing not only scientific topics but also art, music, politics—and the recent war. He was proud to be an Englishman. He suffered many hardships during the war. Lack of sufficient sugar, milk and heat was a great trial to a man of seventy and in delicate health. When the writer visited him a few months ago he seemed in good health, but recent letters tell of digestive troubles and of a fall of eleven feet from a ladder. Perhaps this accident was a contributing cause of his death.

"Few people have seen Heaviside in recent years, and no one has his photograph, so it may be interesting to recall that he was a man of average height, but much above the average in appearance. His face was strikingly handsome, with brilliant eyes, fine teeth and a most remarkably white head of hair. He was slightly stooped on account of rheumatism, and his hearing was not so keen as it might be, though he was far from being stone deaf. His eyesight was perfect. He gave no impression of being an invalid. He had a gracious bearing and manners of a gentleman of the old school and was indeed the type of old scholar one is wont to picture.

"His home, called 'Homefield,' was in the upper section of Torquay overlooking the harbor. No fairer view could be found in England, and no man could better appreciate its beauty than Oliver Heaviside. It might be said that he lived a lonely life, but it is really doubtful that he ever felt lonely. A true artist, he was living in the garden spot of England in close communion with nature and was probably happy."

Program for Electric Section of Illinois Utility Association

A joint session of the three Illinois utility associations — electric, railway and gas—which will meet in Chicago on March 18 and 19, will be held each morning. There will be a "group luncheon" on the first day, and the annual banquet will take place the second evening. A utility advertising exhibit will also be held.

The Electric Association will hold sessions on both afternoons. Wednesday, March 18, J. Paul Clayton, vice-president Central Illinois Public Service Company, will discuss interconnection in Illinois; Cale R. Gough, president Albion Electric Company, "Neglected Opportunities in Small Community Service," and John H. Mitchell, East St. Louis Light & Power Company, "Successful Methods of Application." Theft of energy and its prevention will be dealt with by R. D. Hart of Peoria, E. J. Keller of Mattoon and A. L. Hooper of Gillespie, while George B. Foster of the Commonwealth Edison Company will tell of "Lessons Learned from the Better Home-Lighting Campaign."

On Thursday "The Engineer and the Budget" will be the subject of R. F. Schuchardt, Commonwealth Edison Company; "The Dispatching of Loads Over Extended Transmission Systems" will be discussed by Julius Hecht, Public Service Company of Northern Illinois; "Bringing the Rural Service Problem Up to Date" by Dr. E. A. White, "Municipal Ownership in Illinois" by A. C. Hall, Illinois Power & Light Corporation, St. Louis, and "History of Illinois Electric Business" by Mr. Tholan of the Illinois Commerce Commission.

Byllesby Growth in 1924

Construction Carried Out Brought Addition of 178,000 Hp. at Cost of $32,000,000

THE outstanding feature of the construction program of the operated public utility properties of the Standard Gas & Electric Company in 1924, as published by the Byllesby organization, was the large volume of new generating capacity put into service and connected to the various systems. This reached a total of 177,925 hp., divided between steam and hydro-electric stations. The original budget of $32,000,000 was exceeded.

The largest single project completed was the new High Bridge plant of the Northern States Power Company in St. Paul. Two units of 40,000 hp. rating each were put into service in the new structure, which is designed for a capacity of 200,000 hp. and may be enlarged, if necessary, to an ultimate capacity of 320,000 hp.

In Oklahoma the Riverbank plant of the Oklahoma General Power Company started operations early in January, with a capacity of 30,000 hp. The Horseshoe Lake plant of the Oklahoma Gas & Electric Company at Harrah, about 23 miles east of Oklahoma City, was placed in operation in August.

Other additional steam capacity installed during the year included a new 10,000-hp. unit in the Sioux Falls (S. D.) plant of the Northern States Power Company and an entirely new plant for the Mountain States Power Company at Marshfield, Ore., with a capacity of 6,700 hp.

HYDRO-ELECTRIC PLANTS

Hydro-electric projects completed during the year include the first unit of the El Dorado plant of the Western States Gas & Electric Company on the south fork of the American River in California. This plant has a capacity of 27,000 hp. The Big Fork (Mont.) hydro-electric plant of the Mountain States Power Company was practically reconstructed, and 2,350 hp. of generating capacity was installed. The Red Lake Falls plant of the Northern States Power Company in Minnesota, which was damaged by fire early in the year, was reconstructed and has a present capacity of 1,875 hp.

The most important transmission-line project completed during the year was the 60-mile power loop built around the Twin Cities by the Northern States Power Company for operation at 110,000 volts. The Aldrich substation of the Northern States Power Company at Minneapolis, with a capacity of 45,000 kw., was completed and put into service. Many other substations of smaller capacity were completed at other properties during the year.

Toronto (Ohio) Plant Rapidly Nearing Completion

The first unit of the eleven-million-dollar pulverized-fuel plant under construction by the Ohio River Edison Company at Toronto, Ohio, which was described in the ELECTRICAL WORLD for October 18, 1924, page 834, is rapidly approaching completion. This unit will contain two 33,000-kw. turbine-generators, a capacity that can ultimately be quadrupled as demand grows.

The Toronto plant is joined to the existing Pennsylvania-Ohio Light & Power Company's transmission system by a steel-tower line 39 miles long, running due north to a big substation under construction at Boardman, approximately 200 steel towers being used. Into this substation at Boardman also enter transmission lines from the Lowellville power generating station and the transmission line from Warren recently placed in service as an important link in the superpower program. This "tie-in" connects the Pennsylvania-Ohio system with that of the Ohio Public Service Company, already tied in with the Ohio Power Company by a line from Warren to Canton. The Northern Ohio Traction & Light Company is tied in with both the Cleveland Electric Illuminating Company and the Ohio Power Company. This makes a link from Lake Erie to the Ohio River.

Farm Electrification Progress in Michigan

In company with thirteen other states, experiments in rural electrification are being carried on in Michigan, where a committee for that purpose was appointed by the Public Utilities Commission two years ago. This committee is made up of representatives of the Agricultural College, State Department of Agriculture, agricultural publications, electric public utility companies, state grange and other agricultural organizations. G. W. Bissell, dean of engineering, Michigan Agricultural College, is chairman. There are approximately three thousand strictly rural electric consumers in the state at the present time served by distribution lines financed for the most part by the consumers themselves. It is believed that the business will presently be sufficient to justify the companies in building distribution lines.

The Consumers Power Company is now completing a line which will be placed at the disposal of the Michigan Agricultural College for experimental and investigational work. This line, to be known as the Parma line, extends into the rural district from the village of Parma, Jackson County. It will be 10 miles in length and will serve twenty-five customers.

Snake River Has a Million Latent Horsepower

Maps showing the results of surveys made by engineers of the Department of the Interior to determine the water power available on Snake River, Idaho, have just been published by the Geological Survey. The work done includes a survey of the bed and banks of the stream and the adjacent country from Lewiston, Idaho, to Huntington, Ore., a distance of 187 miles, as well as detailed surveys of five dam sites. In this distance the fall of the river is 1,321 ft., which makes possible the development of more than a million horsepower. A survey of the divide between Snake and Salmon Rivers, an area consisting of 30 square miles, has been made.

In connection with this survey a study of the possible water-power sites on Snake River was made by W. G. Hoyt, who found fifteen undeveloped power sites at which, with the present flow, 1,430,000 hp. can be developed for 50 per cent of the time and 861,000 hp. for 90 per cent of the time. With regulated flow and complete irrigation development 1,080,000 hp. can be developed for 50 per cent of the time and 750,000 hp. for 90 per cent of the time.

One of the projects considered includes a diversion dam on Salmon River, a tunnel to Snake River and a dam 530 ft. high on Snake River. As this project would make possible the development at one plant of 910,000 hp. for 50 per cent of the time and 636,000 hp. for 90 per cent of the time, the site is one of the largest yet undeveloped in the country. A trunk line extending between Salt Lake City and Spokane, which would radiate power eastward to the Mississippi Valley and westward to the Pacific Coast, is suggested by the surveyors. The only development yet made in this stretch of the river is a 12,400-hp. plant near Copperfield, Ore.

Hydro Plants in Venezuela

Building a Station Far Up in the Mountains, with Mules for Transport

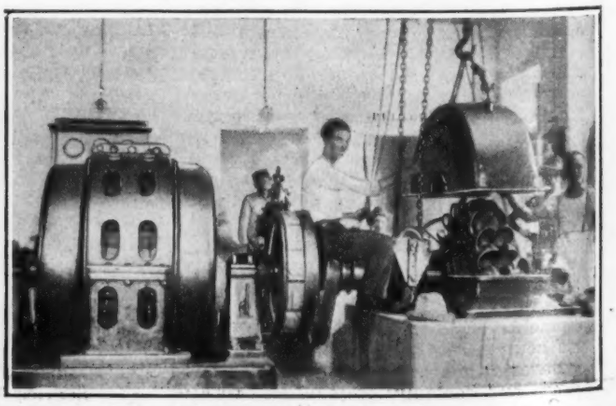
NEARLY fifteen years ago the ELECTRICAL WORLD described one of the earliest hydro-electric stations in Venezuela, that of the Sociedad de Electricidad de Valencia. This plant is at Aguacatal up in the mountains, about 16 miles from the town of Valencia. Ample water is available, and the plant has proved successful not only from the technical point of view but also financially. When started in 1909 it contained two Escher-Wyss 250-hp. turbines coupled to 225-kva. Siemens-Schuckert three-phase alternators. A third turbo-generator set of the same size was added later, and the output of the station rose to 3,000,000 kw.-hr. a year. In 1923 it was decided that a small new station should be built higher up the mountain at a point known as El Milagro.

A dam was first constructed below one of the falls, the water being led therefrom to the pipe intake by a concrete canal three-quarters of a mile in length. It was found that, with the dam about 4,500 ft. above sea level and therefore frequently above the clouds, there was considerable variation in the water supply, and as the mountain is, besides, subject to landslides, it was necessary to provide a water-storage reservoir of nearly 2,000,000 gal. capacity.

The plant at the new El Milagro power station consists of an Escher-Wyss turbine developing 570 hp. with a head of 852 ft. coupled directly to an Oerlikon 475-kva., three-phase generator. Space is available for the installation of another unit of the same capacity as the load increases. The new plant has now been running since May. At first the results obtained were disappointing as not more than 50 per cent efficiency could be obtained. Investigation showed that the trouble arose from the blocking up of the valves by leaves, which had literally to be chiseled out. Steps were taken to prevent a repetition of this trouble, and the set is now working steadily at full efficiency.

The work of this plant has been carried out in a wild, barren district, where owing to the absence of roads virtually all of the material had to be transported up the hills by mules.

NEW EL MILAGRO POWER STATION OF SOCIEDAD DE ELECTRICIDAD DE VALENCIA



INSTALLING THE 475-KVA. TURBO-GENERATOR SET AT EL MILAGRO

Progress in New England

Summary of Important Central-Station Developments Under Way in Four States

MUCH important work now under way in the New England central-station field promises decided gains in system efficiency and development during 1925. An improved mercury boiler will shortly be installed by the Hartford Electric Light Company, following favorable reports from the original plant and from the manufacturers. The Weymouth steam plant of the Edison Electric Illuminating Company of Boston will go into service in the near future, with its pioneer 1,200-lb. boiler and turbine installation, and plans are rapidly being made for the development of a transmission trunk-line system designed to loop from Weymouth around the western suburban district of Boston. The United Electric Light Company, Springfield, is completing the installation of remote-control apparatus for its Birchem Bend hydro-electric plant, and the Holyoke Water Power Company has finished the installation of a remote-controlled hydro-electric station on a canal in the heart of the city. The Greenfield Electric Light Company has increased the capacity of its Gardners Falls plant on the Deerfield River, and the Central Maine Power Company has acquired a new plant site at Clarks Rips, near Lewiston, and is completing the redevelopment of its stations on the Messalonskee Stream, above Waterville. At Providence, R. I., the Narragansett Electric Lighting Company is pushing an extensive development of its South Street station for increased capacity and efficiency, with pulverized coal.

New Transmission Lines

In the transmission field the interconnection of the Turners Falls Power & Electric Company with the Hartford Electric Light Company, is, as elsewhere stated, just ready. This 66,000-volt, two-circuit line will also tie Hartford and Springfield together, and it will be of service in utilizing the surplus hydro-electric capacity of the Connecticut River during the spring months. The New England Power Company has begun the installation of a second circuit on its 110,000-volt line between Davis Bridge station on the Deerfield River and Millbury, Mass., and improved relay applications on its other lines serving central New England have increased the reliability of energy supply over a wide area. North of Boston the utilities operated by Charles H. Tenney & Company are utilizing a connection of increased capacity with the Edison system of Boston, and a large coal storage and handling plant has been inaugurated at Salem with base convenience in case a decision is made to develop a tidewater station in this district.

Good progress is being made on the Montaup steam plant development under Stone & Webster, Inc., near Fall River, Mass., with interconnecting transmission lines tying the Fall River company, the Blackstone Valley Gas & Electric Company and the Edison Electric Illuminating Company of Brockton together. Important betterments are also under way in the generating stations of the lighting departments of the cities of Holyoke and Taunton, Mass.

Construction Budgets in Tennessee in 1924 and 1925

In the biennial report of the Railroad and Public Utilities Commission of the State of Tennessee, covering the period from December 1, 1922, to November 30, 1924, the construction budget of seven of the largest utility companies for 1924 and the incomplete estimate for 1925 are set down as follows:

	1924	1925
Tennessee Electric Power Co.	$7,500,000	$6,000,000
Memphis Power & Light Co.	2,905,000	2,028,000
Memphis Street Railway Co.	440,000	384,000
Jackson Railway & Light Co.	140,000	47,000
Cumberland Tel. & Tel. Co.	3,650,000	3,089,000
Knoxville Power & Light Co.	465,000	228,000
Ky.-Tenn.Lt. & Power Co.	250,000	1,000,000
Total	$15,350,000	$12,776,000

Subtracting the sums estimated for the Memphis street railway and the Cumberland telephone company, there remains the sum of $9,303,000 as the budget of the five light and power companies included. This sum is almost certain to be exceeded, and 1925 will probably be little, if any, behind last year.

Plans to Increase Endowment of Engineering Foundation

Election of Lewis Buckley Stillwell as chairman of the Engineering Foundation, through which research is carried on by the organized engineering profession of the United States, was announced last week following the tenth annual meeting of the Foundation board at New York. Announcement was also made that the four Founder Societies of civil, mining, mechanical and electrical engineers had begun the study of plans to increase the endowment of the Foundation, established by Ambrose Swasey with a gift of $500,000 and recently supplemented by a bequest of $50,000 under the will of Henry R. Towne. Farley Osgood, president of the American Institute of Electrical Engineers, has, it was stated, brought forward a proposal that the endowment be raised to $20,000,000.

Mr. Stillwell, who is a past-president of the A. I. E. E., succeeds Charles F. Rand, who declined re-election after serving five years. Edward Dean Adams was elected first vice-chairman, Elmer A. Sperry second vice-chairman, J. S. Langthorn treasurer and Alfred D. Flinn director and secretary. To the board the following were elected as trustees of the United Engineering Society: George H. Pegram, A. S. C. E.; J. Vipond Davies, A. I. M. E.; W. F. M. Goss, A. S. M. E., and Bancroft Gherardi, A. I. E. E. Edward Dean Adams, Robert Ridgway, Arthur L. Walker, H. M. Bolylston, Arthur M. Greene, Jr., George A. Orrok, Gano Dunn and L. B. Stillwell will represent the governing bodies of the Founder Societies. Elmer A. Sperry, Charles F. Rand and Arthur D. Little were named members at large, and W. L. Saunders, chairman of the Naval Consulting Board, will be a member ex officio as president of the United Engineering Society.

Briefer News

Railway Company in Ohio Sells Light and Power Plant.—The Ohio Electric Power Company has bought the electric light and power business of the Cleveland, Southwestern & Columbus Railway Company for $161,000. This company, with headquarters at Norwalk and a generating station at Elyria, serves several small places between those Ohio cities.

Interstate Public Service Company Seeks to Acquire Small Properties in Indiana.—Petitions have been filed with the Public Service Commission by the Interstate Public Service Company of Indianapolis for authority to acquire the Vernon Hydro-Electric Company and the Orange County Public Service Company. The latter serves Mitchell, Orleans and Paoli, Ind.

Consumers Power Company Aids Reforestation. — The Consumers Power Company has begun a constructive reforestation program in Michigan. Five thousand pines have been set out on the Au Sable River and are being carefully developed. If this plantation is successful, others will follow, and the company will aid the restoration of Michigan's destroyed forests on a large scale, thereby increasing materially, it is hoped, the water-power resources of the state.

Monticello, Ark., to Lease Municipal Plant and Go on High-Tension Lines.—Monticello, Ark., will lease its municipally owned electric system to the Arkansas Light & Power Company and will receive service over the high-tension lines of that company as soon as they can be extended to the city. Monticello has important manufactures and realizes the advantages of central-station supply.

New York Edison's March Exhibitions.—The New York Edison Company's annual electric sign show is to be held during the week beginning March 2 at the Edison Showroom, Irving Place and Fifteenth Street, and its annual electric truck show during the week of March 16 in the same place. Both shows will be of the usual comprehensive and up-to-the-minute description.

Is Keokuk Power House in Iowa or Illinois?—Determination by the United States Supreme Court, probably through an appointed boundary commission, of the dividing line between Illinois and Iowa on the Mississippi River at Keokuk may prove the only way to settle the taxation dispute known as the Keokuk Dam case. The case has been pending in the courts for several years and hinges on a decision whether the power house connected with the Keokuk Dam is on the Illinois side of the river or the Iowa side. The power house is nearer the Illinois shore, but the exact division line has never been determined to the satisfaction of

the dam owners or the State of Iowa. A boundary commission was authorized by the Iowa Legislature, but Illinois failed to appoint a similar commission. The question is now before the United States District Court in Iowa.

Electricity Keeps Oil Well Pumps Operating. — The superiority of electric power for oil-field operation was well demonstrated during recent zero weather by the Amerada Petroleum Corporation, whose eight pumping wells in the Cromwell (Okla.) field are equipped with electricity. With water and gas pipe lines frozen and other wells unable to pump or operate, this company pumped without interruption. An important economy in labor also is credited to the electrical equipment, about six men handling the eight wells.

Site Purchased for Plant on Falls of Ohio.—Thirty-five acres of land has been purchased by the Louisville Hydro-Electric Company, a subsidiary of the Louisville Gas & Electric Company, in Shippingport, a section of Louisville, as a site for the proposed hydro-electric station at the Falls of the Ohio River. This development depends on the construction of a dam by the government to improve navigation. Development of the falls would provide a variable electric generating capacity up to 100,000 hp., depending on the season of the year.

Alabama Power Company's New Gulf Territory.—Sale of the Alabama holdings of the Georgia-Alabama Power Company and the Georgia-Alabama Utilities, Inc., serving a number of southeast Alabama towns, to the Gulf Electric Company was approved on February 18 by the Alabama Public Service Commission. The purchase price involved $500,000. The Gulf Electric Company is a subsidiary of the Alabama Power Company. Its properties serve Eufaula, Abbeville, Enterprise, Newville, Headland, Columbia, Pinckard and Midland City.

Elwell Fellowship in Electrical Engineering Established at Stanford.—Through the gift of Cyril F. Elwell there is available in the electrical engineering department of Stanford University, California, for the academic year 1925-26, a fellowship carrying a stipend of $500 and designated by the authorities of the university as the Elwell fellowship. It is meant to assist the student to whom it is awarded to undertake a year of graduate study. Applications must be received by April 1 by Prof. Harris J. Ryan.

Hartford-Turners Falls Interconnection.—A connection between the Hartford Electric Light Company's system and that of the Turners Falls Power & Electric Company begun last May has been completed, the lines having been tied in at the Agawam (Mass.) substation of the Turners Falls company and energized and tested, with the result that the new connection will be put in commission March 1. This will enable the Turners Falls company to draw on Hartford for 20,000 kw. at any time it is desired—an arrangement made possible by the surplus energy the Hartford company can generate in its steam plant.

Indiana Engineers Push Highway Lighting.—A movement is under way among electrical engineers in Indiana to secure the enactment of a law by the present General Assembly that will provide for the lighting of main highways under the direction of the State Highway Commission. The Indiana Farm Bureau Federation is reported to be active in this movement. An experimental highway line has been built out of Richmond with special highway lighting units installed on poles 400 ft. apart.

Plans of Grays Harbor Railway & Light Company.—In a speech made at Hoquiam, Wash., recently H. W. Crozier, hydro-electric engineer, representing the Federal Light & Traction Company of New York, parent organization of the Grays Harbor Railway & Light Company, said that the Electric Park station of the Grays Harbor company in Aberdeen, Wash., will be made the distribution center for a power system which will supply Willapa and Grays Harbor cities and furnish electrical energy for logging operations in that district. Construction is imminent in the Olympic Peninsula, he said, the only obstacle to the company's plans being the city of Aberdeen's proposed municipal project on the Wynooche River.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, Oklahoma City.

Illinois State Electric Association—Hotel Sherman, Chicago, March 18-19. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

American Institute of Electrical Engineers—St. Louis, April 13-17; Saratoga, N. Y., June 22-26. F. L. Hutchinson, 33 West 39th St., New York.

Southwestern Division, N. E. L. A.—Eastman Hotel, Hot Springs, Ark., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Arkansas Utilities Association, Hot Springs, Ark., April 21-24. R. I. Brown, Arkansas Central Power Co., Hot Springs, Ark.

American Electrochemical Society—Niagara Falls, N. Y., April 23-25. C. G. Fink, Columbia University, New York.

Southwestern Public Service Association—Rice Hotel, Houston, Tex., May 5-8. E. N. Willis, 403 Slaughter Bldg., Dallas.

American Institute of Electrical Engineers, — Regional conventions, Swampscott, Mass., May 7-9; Cleveland, May 22-23.

Missouri Association of Public Utilities—Joplin, Mo., May 7-9. F. D. Beardslee, 315 North 12th St., St. Louis.

Electrical Manufacturers' Club—Hot Springs, Va., May 19-22. S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.

Middle West Division, N. E. L. A.—Hotel Fontenelle, Omaha, Neb., May 20-22. (Conjointly with Nebraska Section). H. M. Davis, Fraternity Building, Lincoln, Neb.

Electric Power Club—Hot Springs, Va., May 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

Electrical Supply Jobbers' Association—Hot Springs, Va., June 2-5. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Association of Engineers—Orlando, Fla., June 2-5. C. E. Drayer, 63 East Adams Street, Chicago.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 8-12. F. Nicholas, 30 East 42d St., New York.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

Norfolk & Western Electrification Proceeding Fast.—The electrification of 22 miles of railroad line by the Norfolk & Western Railway in the heart of the West Virginia coal-field region is expected to be completed in March, giving the Norfolk & Western approximately 60 miles of main-line electrification. The stretch of road now being electrified runs from west of Welch to Iaeger and forms part of the line between Bluefield and Williamson. The road will undertake no further extensions in the near future, but ultimately the Norfolk & Western will probably convert a much greater mileage.

Barstow to Manage Lexington (S. C.) Power Company.—W. S. Barstow & Company announce that the Broad River Power Company, a subsidiary of the General Gas & Electric Corporation, operating in Columbia and Parr Shoals, S. C., will take over the management and control of the Lexington (S. C.) Electric Light & Power Company on May 1. This acquisition follows the Broad River Power Company's purchase of the municipal electric light and power plant of Batesburg, S. C., last month. The new high-tension line from Columbia to Batesburg by way of Lexington is now under construction and is expected to be completed early in May.

Manitoba Engineer Sees Coming Exhaustion of Hydro Resources.—The hydro-electric power resources of Manitoba will be exhausted within twelve or fifteen years and the era of steam-power production will be launched in the West if the present rate of development continues, declared J. F. Sanger, chief engineer for the Winnipeg Hydro-Electric System, in a recent address at Winnipeg. "The water powers of the Winnipeg River will be absorbed within a few years, and then we shall have to turn to steam-power production," said Mr. Sanger. "Already we are producing power this way quite successfully, and as our methods become perfected we can develop electrical energy from coal more cheaply."

Women's Movement Spreads to Great Britain.—In Great Britain there is a Women's Engineering Society, and under its auspices was recently formed a Women's Electrical Association to promote domestic use of electrical energy. The specified objects of the new association include "the exchange of information and ideas likely to help to raise the standard of home comfort, the support of similar societies or movements for promoting the welfare of the people and their homes, the collection and distribution of information regarding the domestic and remedial uses of electricity and all matters relating to the welfare of the home and the family, the promotion of lectures and addresses of peculiar interest to women in the home, the provision of

prizes for essays and hints on new uses for electrical apparatus, the encouragement of schemes in schools and universities with regard to lectureships combining a knowledge of electricity in connection with domestic science, the formation of a group of associations throughout the country having corresponding secretaries who would keep women members in the home posted on all developments of interest to them, and organization of social events, lectures, exhibitions and entertainments."

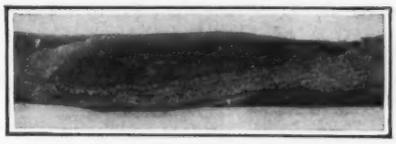
Fort Wayne Utility Taken Over by Insull Interests.—The Indiana Service Corporation of Fort Wayne, which, in addition to operating the traction lines in that and other cities and three interurban systems, supplied light and power in Fort Wayne and twenty-one smaller places and sold energy wholesale, has been purchased by the Insull interests of Chicago, subject to the approval of the stockholders. No price was announced, but it was said that the company would continue to function as a local organization.

Oklahoma Utilities Association Convention.—The meeting of the Oklahoma Utilities Association at Oklahoma City, March 10, 11 and 12, will be addressed by M. H. Aylesworth, managing director National Electric Light Association; Miss R. E. McKee, national chairman women's public information committee of the N. E. L. A.; W. S. Vivian, director of public relations for the Middle West Utilities Company; John C. Hall, an attorney of St. Louis; F. R. Coates, representative of Henry L. Doherty & Company; William B. Way, secretary National Gas Association of America, and J. L. Newland, an editor of Frederick, Okla. The attendance is expected to reach six hundred.

Street-Lighting Progress in the Intermountain States.—A new "white way" lighting district has recently been created by the City Commission of Salt Lake City, which is one of the best-lighted cities of its size in the country. The new district embraces two blocks on First South Street between State and West Temple Streets. The installation will be similar to that of the State Street "white way" system. The installation of a new street-lighting system in Evanston, Wyo., was recently completed and is in operation. The town of Minidoka, Idaho, has recently completed the installation of a modern street-lighting system, which makes it one of the best lighted cities of its class in the West.

Milwaukee Service-at-Cost Negotiations.—Agreement over the question of valuation has finally been reached between the officials of the Milwaukee Electric Railway & Light Company and the public utilities acquisition committee, which are negotiating the proposed service-at-cost contract. This agreement places a temporary valuation on the light, power, heat, street-railway and city bus properties of $56,456,506 as of July, 1925, the date when the contract is to become effective if the vote is in favor of the plan. This figure will be replaced by the exact amount determined when the audit of the company's books is completed up to that time. The audit is now completed up to January 1, 1922, and establishes a valuation at that time of $42,382,000.

Rats Chew Through Lead Covering of Cable.—The illustration shows a piece of lead-covered cable through the covering of which rats have gnawed.



The piece of cable thus attacked was sent to the ELECTRICAL WORLD by L. H. Mickelsen of Racine, Wis.

Madison River, Montana, Has Potential Capacity of 154,000 Hp.—Engineers of the Department of the Interior have, the Geological Survey reports, recently completed a study of the utilization of the water of Madison River, Montana, which shows that its annual flow amounts to more than 1,400,000 acre-feet and that the topographic conditions along the river permit the utilization of a large part of this water for the development of hydro-electric energy and irrigation. The water power available is now partly developed by plants having an installed capacity of 18,000 hp. and by storage reservoirs having a total capacity of 386,000 acre-feet. The undeveloped power resources on the river amount to about 136,000 hp. These estimates do not include power resources in Yellowstone National Park, where development is prohibited.

Two Mayors Cut in New Turbo-Generator.—When a new 17,000-kw. turbo-generator went into operation at the Rockaway plant of the Ohio Edison Company in Springfield, Ohio, recently the company announced a "visitors' week" and had demonstrators on hand to conduct customers through the plant and explain its operation. The picture shows Mayor William Argabright of

Springfield (left) and Mayor A. F. Robinson of Marysville (right) turning the valve which permitted steam to enter the new turbine and formally placed the unit in operation.

Missouri Utilities Change Hands.—The Missouri Public Utilities Company has transferred electric and gas utilities valued at $2,750,000 to the Public Service Company of Missouri under authorization of the State Public Service Commission. The property transferred includes the transmission lines from Cape Girardeau to Sikeston, Morley to Benton, Morley to Blodgett, Poplar Bluff to Charleston, Dexter to Bernie and Charleston to East Prairie and electric distribution systems in eighteen places, as well as isolated electric utilities at Lilbourn and Senath and electric and gas utilities at Cape Girardeau.

Tidal Power Talked of in New Brunswick.—Dilating on Canada's vast water-power resources, Senator C. W. Robinson of the Province of New Brunswick, speaking in the Upper House at Ottawa recently, expatiated also on an experiment now being conducted into tidal-power development at the confluence of the Petitcodiac and Memramcook Rivers in his province and urged the Dominion government to assist in making this tidal-power dream a reality.

Milwaukee Powdered-Fuel Plant Gets Down to 1.15 Lb. per Kilowatt-Hour.—The Lakeside generating plant, leased by the Milwaukee Electric Railway & Light Company, which was one of the first plants in the country to be equipped with powdered-fuel equipment, consumed only 1.15 lb. of coal during 1924 to develop one kilowatt-hour of electricity, according to John Anderson, electrical engineer in charge of its operation. This figure, which is said to set a new record in fuel economy, is equivalent to 15,000 heat units a kilowatt-hour as compared with 17,300 heat units in other large generating plants. The average figure in 1924 for the entire country is given by the United States Geological Survey as 2.2 lb.

Long-Span Transmission-Line Construction Between Iowa and Illinois.—R. M. MacDonald, general manager of the People's Power Company at Moline, Ill., has announced that a 66,000-volt double-circuit transmission line between the company's new Riverside station on the Iowa side of the river and the present electric plant in Moline is being built. An interesting feature of the line is its long-span construction. The spans between towers on the right-of-way are to be approximately 1,000 ft. long, and the line will cross the river with a span of approximately 1,800 ft. from the Iowa shore to a tower on Benhum's island. The two river-crossing towers are 200 ft. high, and the conductors which cross will clear the water at the time of maximum sag by 65 ft., as is required by the government on all navigable rivers. The minimum sag of the conductors will be about 95 ft. There will be a total of thirty towers in the line, four of which will be 127-ft. structures erected on Arsenal Island by permission of the War Department. The line will be ready for service at the time the new generating station is put into operation in July or August.

Men of the Industry

L. B. Stillwell New Chairman of Engineering Foundation

Lewis Buckley Stillwell, nationally known engineer, was elected chairman of the Engineering Foundation at the tenth annual meeting of the Foundation board, held recently in the Engineering Societies Building, New York. This latest honor conferred on Mr. Stillwell, who is a past-president of the American Institute of Electrical Engineers and the American Institute of Consulting Engineers, a director of the United States Chamber of Commerce and a life trustee of Princeton University, is a further recognition of his distinguished

L. B. STILLWELL

contributions to the engineering profession.

Following graduation from Lehigh University he was connected with the Westinghouse Electric & Manufacturing Company and was its chief electrical engineer from 1890 to 1898. He was active in the construction and installation of the Niagara Falls Power Company's first plant and was that company's electrical director from 1897 to 1900, since which he has been engaged in many important enterprises, particularly the electrification of the Manhattan Elevated Railway and Rapid Transit systems in New York and other cities. He was also associated with the electrification of the Hoosac Tunnel.

Mr. Stillwell is a member of the American Society of Civil Engineers, the National Academy of Sciences, the Franklin Institute, the Institution of Electrical Engineers of Great Britain and the Royal Society of Arts of Great Britain.

E. M. Marvin, manager of the Sterling office of the Illinois Northern Utilities Company, has resigned.

Charles R. Pritchard, vice-president and general manager of the Lowell (Mass.) Gas Light Company, has been elected vice-president of the Lynn (Mass.) Gas & Electric Company.

William R. Bowers, formerly of the retail sales department of the Georgia Railway & Power Company, Atlanta, has been appointed superintendent of the Summerville district. Mr. Bowers is well known in electrical circles of the state, having been with the company for a number of years.

Leonard D. Way has been elected third-vice-president of the Hartford (Conn.) Electric Light Company.

R. C. L. Greer, formerly resident engineer of the East Penn Electric Company, Pottsville, Pa., has been appointed general superintendent of the Portsmouth (N. H.) Power Company.

Franklin L. Hall, secretary and treasurer of the Narragansett Electric Lighting Company, Providence, R. I., and **Jesse E. Gray,** assistant secretary of the company, have been added to the directorate, and Mr. Gray has been appointed assistant to the president.

Frank E. Snyder of Montgomery, Minn., has been chosen by the Owatonna (Minn.) Public Utilities Commission as superintendent of the new municipal lighting, power and central heating plant to be put in operation in the spring.

Owen D. Young, chairman of the board of directors of the General Electric Company and member of the Reparations Commission, was awarded the honorary degree of doctor of laws by Johns Hopkins University on February 23 at exercises held in the auditorium of the Peabody Institute to commemorate the forty-ninth anniversary of the founding of the university. Mr. Young is president of the board of trustees for founding the Walter Hines Page School of International Relations in the university and delivered an address at Baltimore in that capacity at the exercises just alluded to.

A. J. Goedjen, manager of the Menominee & Marinette Light & Traction Company, Menominee, Mich., was elected chairman of the Electric Section of the Wisconsin Utilities Association February 6 at the convention held in Milwaukee.

Allen D. Turner, formerly in charge of automotive publicity and advertising, has been appointed manager of the publicity division of the Boston office of the Westinghouse Electric & Manufacturing Company. Mr. Turner, who entered upon his new duties December 15, now has charge of advertising, sales promotion and publicity for the Westinghouse company in New England. Mr. Turner entered the employ of the Westinghouse Electric Company in April, 1922, and for a year was in charge of exhibition and convention work. In April, 1923, he was placed in charge of automotive advertising and publicity, with headquarters at Springfield, Mass.

Major William J. Hammer, U. S. A., retired, formerly of the General Staff, was decorated recently with the insignia of the Legion of Honor by the Deputy Consul-General of France. The decoration should have been conferred thirty-seven years ago, when Mr. Hammer was in charge of the extensive Edison exhibit at the Paris International Exposition of 1889. The papers in the case were lost and the matter only recently came to light. Major Hammer was connected with many of the important developments of early electrical days and was a prominent member of the principal electrical associations. He maintained consulting electrical engineering offices in New York City from 1890 until 1918, when he assumed important war duties for the government.

J. G. Holtzlaw Succeeds Townsend at Beaumont

J. G. Holtzlaw, manager of the Stone & Webster property at Pensacola, Fla., has been appointed general manager of the Eastern Texas Electric Company, Beaumont, Tex., to succeed A. F. Townsend, who has been appointed manager of the Western United Corporation, Aurora, Ill. Mr. Holtzlaw has been with Stone & Webster for seventeen

J. G. HOLTZLAW

years, during which time he has acted as chief executive of the power and traction properties of Pensacola. Previous to that he had served with the Savannah (Ga.) Electric Company. Mr. Holtzlaw is a native of Georgia and a graduate of the Georgia School of Technology.

John E. Loiseau, who has been secretary of the Public Service Company of Colorado for the past two years, has been elected to the board of directors. Although one of the youngest executives in the Doherty organization, Mr. Loiseau has held a number of responsible positions with utility companies under that management.

Edward D. P. Gross has been appointed power engineer of the Hartford (Conn.) Electric Light Company, succeeding H. W. Derry. Mr. Gross is a graduate of the Rensselaer Polytechnic Institute, class of 1913, and has been with the Hartford company for the past three and one-half years in generating-plant work.

F. T. M. Kissel, assistant electrical engineer to the government of New Zealand, has been appointed chief electrical engineer to succeed the late Lawrence Birks. A native of Canterbury, England, Mr. Kissel has been identified for many years with hydro-electric development in New Zealand.

Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company of Baltimore, has been elected a director of the Society for

Electrical Development to represent central-station interests. A graduate of Stevens Institute of Technology, Mr. Wagner for a number of years has been an outstanding figure in the electrical industry. The Wagner Electric Manufacturing Company was organized by Mr. Wagner, who was its first president, and to him goes the credit of developing the first successful single-phase motor placed on the market. He has always been active in the interests of the National Electric Light Association and for many years has served on its executive, public policy and other committees.

Fred Capshaw of Oklahoma City, Okla., has been elected a member of the Corporation Commission of that state for a six-year term.

Robert E. Dillon has been appointed superintendent of the generating department of the Edison Electric Illuminating Company of Boston, succeeding the late Charles H. Parker. Mr. Dillon has been assistant superintendent of this department since the fall of 1917 and previously was head of its technical division and in the steam engineering division of the Boston Edison laboratory.

B. J. Denman, vice-president and general manager of the United Light & Power Company, which recently acquired the Continental Gas & Electric Company, has become vice-president and general manager of the Continental properties, including the Nebraska Gas & Electric, Maryville Electric Light & Power, Kansas City Power & Light, Lincoln Gas & Electric Light and the Columbus (Ohio) Railway, Power & Light.

E. H. Gilliam, formerly general superintendent of the Southern Cities Power Company at Columbia, Tenn., has been transferred to the company's engineering department at Chattanooga. The change was necessitated because of the increased activity in the engineering department resulting from the company's expansion throughout the state of Tennessee.

L. H. McCray, who recently resigned as assistant general manager of the East Penn Electric Company, Pottsville, Pa., is now manager of the Portsmouth (N. H.) Power Company and the affiliated organization, the Kittery Electric Light Company.

Miss Jean K. Rich, a graduate of the University of Wisconsin, has been placed in charge of the home economics department recently inaugurated by the sales department of the Illinois Power & Light Corporation. This new department will supervise all home economic activities throughout the company's system.

Tom J. Casey, who was reported in the January 31 issue of the ELECTRICAL WORLD to be engaging in the manufacture of electric laundry machinery in Chicago in partnership with George F. Ringhoff, has relinquished the laundry business entirely and is now devoting himself to the electric washing-machine business as vice-president of the Farrell Products Company. Mr. Casey was formerly vice-president of the Hurley Machine Company.

A. H. Warren Assumes New Duties in Savannah

Alba H. Warren, who has been made Southeastern district manager of all Stone & Webster properties in Georgia and Florida, as announced recently in the ELECTRICAL WORLD, has taken up his new duties in Savannah. This is one of the most important of the Stone & Webster districts, and the selection of Mr. Warren to fill this post is a tribute to his ability as utility executive. He has been manager at El Paso, Tex., a Stone & Webster property, since 1918 and has been connected with that organization since 1900.

He successively held the positions of assistant treasurer Houghton County Traction Company, Houghton, Mich., 1902-4; superintendent Houghton County Traction Company, 1902-4; manager Brockton & Plymouth Street Railway Company, Brockton, Mass., 1904-8; manager Pensacola (Fla.) Electric Company, 1908-13, and manager Galveston (Tex.) Electric Company, 1913-18, before taking up the managership of the El Paso Electric Railway Company six years ago.

A. H. WARREN

T. W. Smith, general superintendent of the Wheeling (W. Va.) Electric Company, has resigned.

P. H. Wheeler, formerly district engineer for the Consumers Power Company at Jackson, Mich., has been appointed manager at Mason.

S. M. Conant, for the past twelve years district manager of the Baltimore office of the Crocker-Wheeler Company, has been appointed assistant sales manager of the company, with headquarters at Ampere, N. J. Mr. Conant has been identified with that organization since 1903, when he affiliated himself with the Atlanta office. Previously he was employed by the old Bullock Electrical Company of Cincinnati.

E. J. Emanuel, who was recently elected a vice-president of the Albert Emanuel Company, Inc., will have complete charge of the commercial departments of the properties operated by that company with headquarters in New York. Mr. Emanuel first became associated with the companies in 1913 at Sidney, Ohio, and since that time has served in numerous capacities at Williamson, W. Va., Albion, Pa., and Parsons and Emporia, Kan. In addition, he was associated for two years and a half with independent jobbing and merchandising concerns and also with the Lexington (Ky.) Utilities Company. During the past three years he has had charge of the merchandise department of the Kansas Electric Power Company, the Eastern Kansas Power Company and the Southwest Power Company. Because of his extensive training in this branch of the company's business and his intimate association with so many of its properties he is eminently fitted for his new work.

Obituary

Albert F. Rockwell, at one time president of the New Departure Manufacturing Company, Bristol, Conn., and of the Marlin-Rockwell Corporation, New Haven, Conn., died at New Britain, Conn., February 16.

Robert McF. Double, formerly connected with the Central Colorado Power Company and for eighteen years a resident of Denver, Col., died at San Francisco, February 14, in his sixtieth year. Mr. Double during his association with the Central Colorado organization designed some of its hydro-electric plants.

Edward S. Gilmore, electrical engineer, who was superintendent of the steam service division of the Westinghouse Electric & Manufacturing Company at Denver for the past four years, died of a complication of diseases at the Phelps-Dodge Corporation Hospital, Dawson, N. M., February 18.

William Pierson Judson, president of the Broadalbin (N. Y.) Electric Light & Power Company, died at his home in that place February 12 in his seventy-fifth year. Mr. Judson was United States assistant consulting engineer on forts, rivers and harbors from 1870 to 1899 and Deputy State Engineer of New York from 1899 to 1905.

Dr. Saitaro Oi, an active director of the Nippon Electric Company, Limited, since 1919, died at Tokyo December 29. An eminent communication engineer, Dr. Oi was considered the father of the telephone service in Japan. He had traveled extensively on the Continent of Europe and in the United States to study telephone development. Dr. Oi was a past-president of the Japanese Institute of Electrical Engineers and had received decorations from Denmark and China as well as from his own government.

E. G. Cleminson, assistant general manager of the Nebraska Power Company at Council Bluffs, Iowa, died suddenly February 13 at his home in that city. Mr. Cleminson entered the public utility field in 1903, when he became a clerk in the Citizens' Gas & Electric Company of Council Bluffs. He maintained this association until 1915, when he joined the Nebraska Power Company as general auditor. Subsequently he was made head of the investment and public relations department, later becoming assistant general manager in charge of these departments. Mr. Cleminson had been legislative representative for the power company for some time.

Commission Rulings

Room Basis Substituted for Active-Load Basis in Rate Making.—Granting authority to the Darlington Electric Company, which serves a town of 1,800 people, to increase its rates, the Wisconsin Railroad Commission authorized an electric rate schedule for residence lighting based upon the number of rooms in place of a former schedule based upon active load, in order to obviate objections to the inconvenience and cost of inspections. Consideration was given to the total investment which would be established after the completion of necessary rebuilding and replacement of the property, and the importance of a reasonable allowance for working capital was emphasized.

Commissions Are Not to Manage the Utilities Under Their Jurisdiction.—Refusing a petition to force the use of telechronometers on the Puget Sound Telephone Company, the Department of Public Works of the State of Washington said: "There is a vast difference between permitting a utility to experiment in the interest of science and progress and compelling it to do so against its will. We have been told by the courts that we are not the managers of the business of the utilities within our jurisdiction. It is within our power to require them to render efficient service at reasonable rates. The details should be left to the utility. There are circumstances under which we might be warranted in ordering the measured service, but we do not feel that they exist in this case."

No Arbitary Ratio Can Be Set to Represent Proper Gross Revenue from Extensions.—The Maine Public Utilities Commission has disapproved a contention made by the Central Maine Power Company that a gross revenue of from 30 to 33 per cent upon an extension ought to be assured. "We have not heretofore in cases of this kind," the commission said, "and shall not in the instant case, attempt definitely to fix and determine any specific percentage of revenue which must be assured in all cases before the company ought to be required to extend its service to a rural community. Such percentage of gross revenue to total investment must necessarily vary with the varying circumstances and conditions surrounding the different cases in which extensions are requested."

Commission Not Bound to Assent to Agreement Between Utility and Customer.—In assenting to a rate agreement reached between the Kootenai Light & Power Company and the Troy Packing Company the Montana Public Service Commission emphasized the point that, though it is always eager to aid in the informal disposition of rate litigation, it is not at liberty always to dispose of such matters merely because the parties concerned have reached an agreement or been found in accord. "Under the law," the commission said, "it is the commission's duty to find and prescribe a reasonable rate. The rate agreed upon by parties desiring the settlement may or may not be reasonable, and in any event its character is to be determined only after a study of its effect on all the customers of a utility and not merely with reference to the fact that it is agreeable to the utility and the particular customer."

Service of Large Consumers Is Public Use as Much as Is Domestic Service.—The New York Public Service Commission holds that the production of light, heat and power by the Niagara, Lockport & Ontario Power Company at a proposed water site would be for public use, although the major part of the power would be distributed to electric railways, distributing companies and industrial concerns instead of domestic users. The commission said: "The petitioner sells and distributes electricity to electric railroads, to municipal plants, to distributing companies, to industrial concerns and to domestic users. . . . The land owners take the position that the sale and distribution of electrical energy by petitioner to such users is not for public use. It would appear that they limit public use to the use of domestic consumers inasmuch as they argue that 95 per cent of all sales of petitioner are not for public use. . . . It is our view that any electric railroad, any distributing company, or any industry within the territory served by the petitioner, under reasonable and proper regulations, may demand and is entitled to receive the services of the petitioner equally with any domestic user. The petitioner is a public service corporation within the definition of the Public Service Commission law."

Recent Court Decisions

Time Allowed for Appeal from Commission Decision.—A technical point of interest to utility companies operating in Ohio was determined when the Supreme Court of that state (in suits brought by Dayton and Akron against decisions of the Public Utilities Commission affecting telephone rates) laid down the rule that the time from which to compute the sixty days allowed for the institution of proceedings in error from the commission to the Supreme Court, under the provisions of the law, is the date of entry of the final order on the journal of the commission, and not the date of the overruling of the application for rehearing. (145 N. E. 849.)*

Only Right to Use Water Power Appurtenant to Property Passes with Grant.—McMillan vs. Etter et al. was a suit to enjoin defendants from rebuilding a destroyed dam on a stream on which a hydraulically operated mill had once stood, the site of which defendants had purchased. The question at issue was whether flowage rights went with the purchase. The Supreme Court of Michigan held that neither grantor nor purchaser intended conveyance to include the right to flow lands of others where the contract made no mention of flowage rights. The right to use power from a dam appurtenant to the property of grantor will pass by grant of property, the court said, but, if the power was not appurtenant to the property at the time of grant, it did not pass. (201 N. W. 499.)

New York Supreme Court Insists on Rate Basis Considering Cost of Replacement Less Depreciation.—In State of New York ex rel. Adirondack Power & Light Company vs. Public Service Commission, the Appellate Division of the New York Supreme Court has found fault with the method of valuation adopted by the commission as out of harmony with recent pronouncements of the United States Supreme Court and has sent the case back to the commission for rehearing. Part of the New York Supreme Court's finding follows: "The present increased cost of construction must be considered in determining the value of the property, and due weight must be given to such present reproductive cost. The Supreme Court has refused to adopt the prudent investment cost theory. Concededly the commission has ignored present (1921) reproductive costs of the relator's properties in determining their present values and has adopted a rate base which only squares with reproductive cost based on ten years' average prices covering the ten-year period prior to 1921, less depreciation. The commission was divided as to the rate base to be allowed. We are assuming the higher one to have been adopted by a majority of the commission, namely, $370,000, although the divergent opinions of the commissioners leave the question in doubt. Upon this basis we find that the commission totally ignored the only testimony in the record giving cost of reproduction based upon present (1921) prices. One witness, at 1921 prices, testifies to present reproductive cost new at $842,000 and less depreciation at $730,000. Another witness testifies to present reproductive cost new at $732,000 and less depreciation at $664,000. . . . This vast discrepancy, even applying the highest percentages of depreciation found in the record, demonstrates that due weight has not been given to the only testimony in the case giving present reproductive costs in determining present value. . . . Even assuming the rate base adopted as fair and that the rate will yield to the company . . . 7.1 per cent return on that rate base, we think such rate of return under the circumstances of this case may well be considered inadequate, in view of the holding of the Supreme Court in Bluefield Waterworks & Improvement Company vs. Public Service Commission. In that case the Supreme Court referred to the fact that the company had received a rate of return that was very low through a long period up to the time of the inquiry by the commission and that such fact should be taken into consideration and a higher rate allowed in order to be fair." (207 N. Y. S. 284.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

The Common-Sense of Standardization*

Uniform Electrical Ordinance to Make a Universal Interpretation of the National Electrical Code Possible and Urgently Needed

By J. H. Trumbull
Governor of Connecticut
President Trumbull Electric Manufacturing Company,
Plainville, Conn.

IT IS all very well for men to express their individual taste in art, music, and to a certain extent in food, clothing and homes, and also in non-essential details of many classes of manufactured goods, but unless the basic materials were standardized to permit their production in large quantities at a low cost, only the very wealthy could enjoy the comforts which are now the common, and often unappreciated, property of every American. There are more telephones in New York City than in all of England. Our cheapest tenements have sanitary plumbing, gas or electric lights, and telephones, musical instruments, radio, motion pictures and cheap transportation are within the reach of every one. The luxuries of foreign countries are commonplaces to us, but none of these things was possible without standardization. Standardization encourages simplicity, and these two things together form the foundation of all our manufactured goods, building materials and machinery.

But standardization has not yet become as universal as it should be. Therefore many leaders among electrical men are working for a uniform interpretation and adoption of the National Electrical Code and in promoting this idea are adding safety to simplicity and standardization.

This work takes on a vital and human interest. Electricity has become our greatest servant, familiar to all. No one thinks of building today without installing adequate wiring, whether he live in the city or the country. His wiring job, however, is dependent not only on the skill and honesty of the workmen, but also on the regulations for wiring in force in his particular locality.

Why Are Different Rules Needed?

Now, does it seem reasonable that a house in the city needs a safer wiring installation than a home in the country? Would you think Seattle needed rules affecting wires in damp places that would not also apply in New Orleans or Boston? No, it is possible to make a common and universal rule for each detail. Moisture is wet anywhere, lightning is destructive everywhere, and if a No. 8 wire will safely carry the current in one place, it will carry the same current in every other place.

According to some of the local rulings in various parts of the country, however, it would seem that electricity differs in character according to the locality in which it is distributed. I know there are direct current and alternating current and all kinds of voltages, cycles and phases, but why is it still necessary to use No. 6 wire for a ground connection in some places when No. 8 has been permitted by the code for the past two years? Surely both cannot be right under the same conditions. Why is an identified wiring system mandatory in progressive localities, while many places still allow the ungrounded conductor to be connected to the shells of sockets? Is electricity any less deadly or more fireproof in some places where ignorance and indifference rather than a common-sense progressiveness may be in control?

J. H. Trumbull

It is quite recently that a standard attachment plug was adopted. At one time probably 90 per cent of all the electrical appliances sold which were already equipped with attachment plugs had to have the plugs changed in order to fit the purchaser's convenience outlet. There is no estimate of the unnecessary cost and annoyance that was caused by this fitting alone and was paid for by the people who might better have spent that money for more constructive labor.

Switches, for Instance

As a manufacturer of switches I have seen much money wasted because of lack of standardization. When the time came to inclose the open-knife switch, no less than five different types of inclosures were devised—all approved by the underwriters under various classifications, and on account of this variety, which causes distrust and confusion on the part of many of the users, we have had to make—and still do make—four of these five classes of switches, and it seems likely we shall be forced to make the fifth class before long.

Meter service switches are divided into two great classes — those which have the service fuses only accessible to the customer and those which have both service switch and fuse under the lighting company's seal. Can both methods be right? We are believers in the sealed-service fuses, as I believe most of you are, especially if you have made many collections of pennies, wires, washers, etc., that were used to short-circuit fuses. (I heard of one inspector, though, who was in favor of the accessible service fuses because his inspections were netting him anywhere from $7 to $12 per month extra, in pennies, dimes and nickels he collected from the space back of fuses!) However, some of the larger utilities still believe that the public can be educated to replace fuses properly, and their records of fires and accidents must be satisfactory or else they would not continue the practice.

Cost of Duplication

Division of opinion and lack of standardization cost money—real money—and the cost is reflected directly back on each one of us. If there are two opposite methods, it doesn't seem possible that both can be right, but assuming that both can be right, then either one ought to suffice in the interest of economy. Manufacturers are spending enormous sums along the lines of standardization and are always ready to meet the code, for it stabilizes their large investment, and when a product is stabilized they can spend money for machinery and tools without fear of these having to be scrapped the next month. You will find manufacturers' representatives on all kinds of standardization committees, and while they are all in business to make money, most of them are forever striving to give the ultimate consumer more for his money than he ever had before.

The National Electrical Code is a product of many years of experience by able and conscientious men, and the inspector's job is to arrive at a uniform interpretation of it for his district and to promote and aid a similar adoption in every other part of our country, so that then we shall have another United States standard, recognized and probably used by foreign countries as well.

I cannot stress too much the importance of this work. Every one of us should, and probably does, feel that he plays an important part in guarding the lives and property around us. By doing our utmost to further the universal adoption of a uniform code we are promoting standardization, which results in simplicity, lowers the cost and makes possible an ever-increasing number of comforts and luxuries, at the

*An address before the Eastern Association of Electrical Inspectors, Hartford, Conn., February 23, 1925.

same time providing safety and thus permitting the enjoyment of all these things without regret.

Electrical Credit Men Encourage Simplification

THE Central Division, National Electrical Credit Association, is giving consideration to the movement to standardize purchase order forms in line with the policy adopted by the National Association of Purchasing Agents and the Department of Commerce, Division of Simplified Practice. At a meeting in Chicago particular emphasis was placed on the importance and feasibility of early adoption of standard forms for purchase orders, to be followed later by the adoption of the standard zone system as advocated by the Division of Simplified Practice.

The economies to be effected by standardized purchase order forms were recognized by all members of the association, and it was further agreed to exchange ideas and form blanks of various types as used by electrical credit men to assist in the standardization movement.

Better Motors Wanted for Refrigerators

Conference of Motor and Refrigerator Manufacturers Proposed to Develop Specifications for Ideal Refrigerator Motors—What the Jones Committee Is Doing

THERE is pressing need for a special type of fractional-horsepower motor for domestic refrigerating machines, according to opinion expressed at a recent conference called by T. I. Jones, chairman of the committee investigating domestic refrigeration for the National Electric Light Association. Mr. Jones is also chairman of a similar committee of the Association of Edison Illuminating Companies. There were present members of the N. E. L. A. committee, manufacturers of electrical refrigerators, manufacturers of electric motors and representatives of the electrical and refrigeration press.

Motor Situation Thoroughly Discussed

Few motors now on the market are suitable for application to domestic refrigerating machines, in the judgment of the refrigerating machine manufacturers, who claim that motor manufacturers have not yet appreciated the present and potential demand for motors for this class of service, nor have they considered the major requirements. The necessary features in order of importance were given as follows: (1) Reliability; (2) quiet operation; (3) high efficiency, and (4) high power factor. Under the head of reliability, such features as the ability to operate for long periods and without the addition of lubricant or the renewal of brushes were stressed. The refrigerating manufacturers admit that the motor manufacturers have made some progress along these lines, but they were almost unanimous in saying that the motors are too noisy and that even motors of a given line are not uniform in this respect. The normally quiet motor, they say, is not good enough for this service, owing to the peculiar acoustic conditions which surround many of the applications; but the great need is for a heavy overload capacity combined with a high degree of efficiency at light loads.

The motor manufacturers, while they may have been doubtful as to the present and potential demand for motors for domestic refrigerating machines, have not been oblivious to the demand for motors which are particularly adaptable to domestic refrigerators; but they have hesitated to develop special motors until there is harmony of opinion regarding the major requirements and until they are assured that refrigerator manufacturers are willing to pay for the improved characteristics. They contend that none of the requirements is beyond achievement so long as the user is willing to pay for them.

Refrigerator manufacturers frankly stated that the price of the motor was a secondary factor, because freedom from service troubles and greater satisfaction for the customer would quickly offset higher motor cost. One company told of experience with a special motor that has been developed for it by a small motor manufacturer and which seems to be ideal. It is costing twice as much as a standard motor of this size, but has been entirely acceptable at that price, pending the development of larger production, which will gradually reduce the cost.

In the hope of a joint study of the refrigerator motor problem by the manufacturers of the refrigerating equipment and the motor manufacturers, this committee was requested to further co-operate in looking to the development of an ideal specification for domestic refrigeration motors that may be accepted as a standard. This was done in the belief that the growth of the market for domestic electric refrigeration will eventually produce a volume of business that will bring down the price to present levels for machines now in use.

Elaborate Program of Committee Promises Constructive Progress

The meeting gave evidence that the committee is following a very elaborate program that promises some constructive progress, in which the individual members of the committee are each taking responsibility for definite research.

T. I. Jones has been carrying out a series of tests on the domestic refrigerating machines in actual use in homes and hospitals in Brooklyn. A recording thermometer is installed in a central location in the room where the machine is used, and another in the center of the ice compartment, and a continuous temperature record is kept. A recording wattmeter and a recording ammeter are also installed and charts are replaced weekly. There now is a complete record covering a period of nine months, and a year's record will be available by the end of the year when the report comes out.

W. E. Clement, new-business manager of the New Orleans Public Service Company, is studying the value of the refrigerator to the central-station company, keeping a record of consumption of the various appliances in the home, to get a comparison with the refrigerator, and watching also consumption of energy per kilowatt demand. He already has five thousand records of machines in use all over the United States.

E. W. Lloyd, general contract agent of the Commonwealth Edison Company, is compiling a record of selling methods in use all over the country, embracing the practice both of the manufacturer and the central station.

A. D. McLay, industrial engineer Detroit Edison Company, is making a study of plant and ice sales, compiling data all over the country of central-station rates to ice manufacturers, the cost of ice supplied, etc.

G. E. Miller, new-business manager Cleveland Electric Illuminating Company, is investigating ice-cream cabinets, soda fountains and water-cooling installations, making a record of experience all over the country.

R. M. Tillman, new-business manager of the Consolidated Gas, Electric Light & Power Company, Baltimore, is making a machine census and compiling a record of all the machines on the market, their design, etc., clearly indicating those machines that are still in the minds of the promoter, those that are not yet proved and those that have been established as commercially successful.

R. R. Young, new-business manager of the Public Service Electric & Gas Company, Newark, is making tests on machines to show how they actually operate in room temperatures from 60 deg. to 90 deg. He is testing the leakage of doors, the operation of rheostats and all details of the design and operation of equipment.

R. E. Fisher, vice-president Pacific Gas & Electric Company, is acting as Pacific Coast representative for all the other members of the committee in making up a Pacific Coast record of all the different aspects which are being covered.

The consideration of the ethics of this new refrigerating industry is attracting the attention of electrical men right now. The public interest in electric refrigeration for the home has become very keen, and there have been a large number of cases where brokers have undertaken to sell stock for the financing of companies to manufacture refrigerators. Impossible claims of efficiency have been made with no basis other than imagination. This practice is becoming so extensive that the committee felt that a definite effort should be made to warn the industry against such unfair methods.

It was announced that the reports of the N. E. L. A. and the Edison Association committees would be handled together and issued jointly, the first

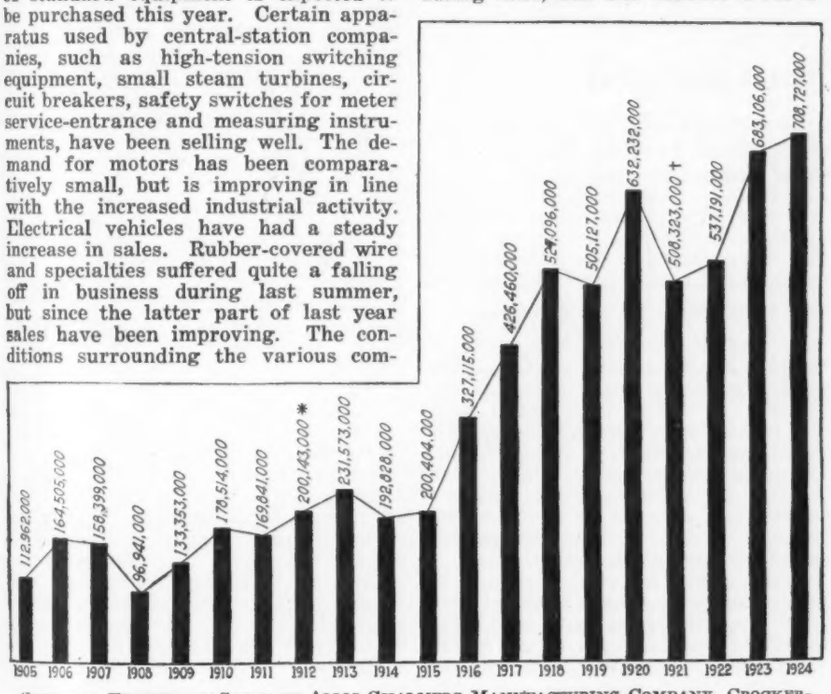
one in June at the N. E. L. A. convention in San Francisco and the other in September.

It is the purpose of the investigating committee to report definitely on the performance of the various refrigerators which have been proved through this investigation to be practical and satisfactory for domestic service. The N. E. L. A. report will be made public in all details, and executives of the N. E. L. A. have agreed to take the advice of the committee and act on its recommendation. The Edison committee's report may not be made public in full.

Trend of Electrical Sales

Manufacturers of Various Products Report Demand for 1924—Steady Improvement in Business Is Expected to Continue with Good Sales This Year

MANUFACTURERS generally express the opinion that business has been showing a slow but steady increase and all look confidently to a continuation of these conditions during the year. On the whole, no rapid or very large increases are anticipated. Railway electrification has been especially active, and a fairly large amount of standard equipment is expected to be purchased this year. Certain apparatus used by central-station companies, such as high-tension switching equipment, small steam turbines, circuit breakers, safety switches for meter service-entrance and measuring instruments, have been selling well. The demand for motors has been comparatively small, but is improving in line with the increased industrial activity. Electrical vehicles have had a steady increase in sales. Rubber-covered wire and specialties suffered quite a falling off in business during last summer, but since the latter part of last year sales have been improving. The conditions surrounding the various commodities as listed above are discussed further in detail.



COMBINED ELECTRICAL SALES OF ALLIS-CHALMERS MANUFACTURING COMPANY, CROCKER-WHEELER COMPANY, GENERAL ELECTRIC COMPANY, WESTERN ELECTRIC COMPANY AND WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

(a) Munitions sales during the war years and non-electrical sales not included.
(b) Western Electric sales do not include purchases from any of the above companies.

*Fort Wayne, Sprague and National added to General Electric sales.
†Southwest General Electric added and International General Electric omitted from General Electric sales.

Purchase by railways, principally of standard equipment, were fairly large last year. Much apparatus has already been ordered this year for city railways and interurban systems, and this business is expected to show a material increase. At least four roads during the past year took active steps toward electrification or toward increasing present electrical equipment. Various studies now under way, both in this country and abroad, indicate the resumption of railroad electrification work on a much larger scale than ever before. Sales of automatic substation equipment for railway service are increasing rapidly. An unusually active year is expected.

There has been a consistent demand for higher insulation, greater factors of safety and greater spacings in high-tension switching and protective equipment. Apparatus for voltages of 110,000 to 165,000 was in heavy demand during 1924, and this demand is steadily increasing, manufacturers say. The demand for both motor-operated and manually operated remote-control equipment is also increasing. One company believes that more careful consideration should be given this apparatus before adopting it too freely. Opinions as to the future agree as to an increased demand. This view is aptly expressed in one case by saying that the best evidence lies in the program of the company calling for expansion of plant, sales and organization facilities.

Both present and future small-turbine business is exceedingly bright, according to manufacturers. The past year witnessed great activity in meeting the ever-increasing engineering requirements incidental to a rapid increase in steam pressures. This shift to higher pressures has affected pump design, and with increasing use of central-station power there has been a stronger demand for high-efficiency pumps, the present indication being that this demand will continue.

A manufacturer of circuit breakers reports a very big year, and in more than one instance it is said that manufacturing space has been increased. Attention is especially called to the fact that more apparatus is being made remote-control, with a corresponding demand for motor-operated and solenoid-operated devices. A big and prosperous year is anticipated by various companies.

In the safety-switch field sales are reported as very good. The meter-service-entrance switch has been in particularly good demand, and one manufacturer reports that the value and volume of his 1924 business were 50 per cent greater than in any previous year. Present orders booked for 1925 deliveries will make the first quarter's sales of this company larger than in any quarter in 1924.

INTEREST IN MEASURING INSTRUMENTS

Manufacturers state that sales of instruments have been very good since last fall, and it is believed that they will continue so throughout this year. The demand for watt-hour meters has fallen off in some localities, owing to local conditions, but improved demand from other sections has maintained the sales volume. Interest in kva. measurement increased during the year, one company announcing an instrument for this purpose, and at least one other is planning to put a kva. meter on the market this year. A foreign manufacturer has also actively entered the field recently. Instruments for energy-consuming surveys have been developed and installed, particularly for the analysis of electric range loads, and the demand for such instruments has increased.

INCREASE OF MOTOR STOCKS A SIGNIFICANT FEATURE

A significant feature of the motor branch of the industry has been the increase in stocks of general-purpose motors, manufacturers taking the opportunity offered by a decreased demand to make this increase. It is felt that sales are bound to improve, and improvement has already been noticed in the last few weeks. Moreover, it is believed that there will be a continued and increased demand for motors for applications that have not been general in the past as well as because of the extension of power company lines, which has opened up new fields.

There was a steady increase in sales of electric vehicles during last year, aided by the opening up of new potential fields, especially the dairy industry. There has been greater geographical distribution because of extended sales representations, and an increase in central-station co-operation and the purchase of electric trucks for station use is reported.

The rubber-covered wire industry reports steady strides along the lines of

reducing labor costs and improving the quality during the year 1924. One company states that the electrical results being obtained today are far higher, on a general average, than even the high average attained for many years past, and this company is confident that it is working along lines which will bring still further improvement. Competition since the middle of last year has been very severe, and during the summer months the amount of business placed was considerably below the average. However, since the latter part of last year evidences of an expanding business have become more and more apparent, and present good sales are expected to continue through this year. Great strides have been made during 1924 in improving the dielectric strength of varnished cambric and in improved methods of applying it. Much improvement has been made in the construction of paper cable, for which there has been a good demand. One company has joined with a paper cable manufacturer of Europe and is constructing a plant which will be devoted to the manufacture of paper cable under the European company's patents.

Keen competition has existed during the past year in the sale of electrical specialties, and manufacturers state that the prices of several articles are ridiculously low. The demand has been steadily improving, and a good increase in business is expected during the year. Automatic temperature as well as time and temperature control has been fully developed for use with electric ranges, and exceptional sales are looked for.

One company states that its sales of residential glassware, not including kitchen-lighting glassware, have been showing a marked increase. There was an increase of 33,000,000, or 13½ per cent, in the number of incandescent lamps sold during 1924 over the previous year, not including the miniatures used in automobiles, flashlights, etc. More than four and a half times as many lamps were purchased in 1924 as in 1908. The estimated number of miniature lamps sold in 1924 is 210,000,000, an increase of about 20 per cent over the year previous.

Wiring Code Not Changed

Changes in Article 5 of the National Electrical Code Not Adopted in the 1925 Revision — Conditions to Have Further Study — Editorial Revision Chief Work of Committees on Code

THE changes suggested in Article 5 of the National Electrical Code, "Wiring Methods," Sections 501, 502 and 611, covering a proposed new wiring method for open or concealed work, were not adopted by the sectional Electrical Code committee when it met last week at the Underwriters' Laboratories, New York, to make recommendations covering the 1925 edition of the National Electrical Code.

In the absence of the chairman of the committee on Article 5 the report of this committee was presented in three sections. The first section dealt with three-wire, single-phase systems, inside of buildings, derived from auto-transformers as balancing coils, and was referred back to committee. The second section dealt with editorial changes. The third section covered the proposed new wiring method, which the article committee recommended be not adopted. This recommendation was approved. A resolution was proposed and adopted by the article committee, "recording it to be the sense of the electrical committee that assemblies of twin and multiple conductors without metallic covering, when the wires with their protective covering are approved by the Underwriters' Laboratories, may be safely used when installed under specific limitations." It was also proposed and adopted by the sectional electrical committee "that the drafting of the rules covering the use of approved assemblies of twin and multiple conductors be referred to the committee on Article 5 to co-operate with the Underwriters' Laboratories and present to the next meeting of the electrical committee rules covering the proper use of such assemblies." Apparently the principle involved was not denied, but it was the intention of the sectional committee to have rules formulated to limit its application, and so the question was referred back to the committee and the Underwriters' Laboratories.

MAIN REVISION IS EDITORIAL

No radical changes were made in the 1925 National Electrical Code. The chief aim of the committee was apparently to resort to editorial revision and to carry further the very good work done in producing the 1923 code. The result has been that the next edition will be much easier to read and understand. It will be more nearly free of errors and without conflicts and ambiguous statements.

Under the present system the recommendations of the sectional electrical committee must go to each member of the committee for a mail ballot. After such approval is obtained, the recommendations will go before the National Fire Protection Association on May 10. They are required to be in preprint form thirty days before the meeting. The N. F. P. A. can indorse the recommendations in open meeting. After the indorsement the revision is sent to the American Engineering Standards Committee for submission to its membership for mail ballot indorsement, after which the code can be released in printed form.

The more important code changes that were recommended are given as follows: It was decided to insert in Section 206 details of requirements regarding the identification of terminals of wiring devices to become effective April 1, 1926. In Article 3, "Outside Work; Pole Lines," the location of transmission lines with respect to buildings other than central-station plants was specified.

A few details were added to Article 4, "Services," regarding the safeguards to be applied when circuit breakers are to be used in place of fuses. The committee recognized the use of small circuit breakers instead of fuses on low-capacity circuits and placed itself on record that a circuit breaker might be acceptable for small circuits, but if used should be approved.

Under Article 6, "Conductors," the use of a flexible cord of No. 18 gage copper with a $\frac{3}{64}$-in. rubber insulation was approved. The 1925 code will also require all key sockets of the single-pole type to break the center contact instead of the screw shell. This is to become effective Sept. 1, 1926. Under this article the method of polarity identification is also specified. The code does not require it, but if used, it is to consist of a contrasting braid on one of the two conductors, the marked wire being used as the ground wire.

FULLY INCLOSED APPARATUS

In Article 8, "Automatic Protection of Circuits and Appliances," another step was taken in the direction of fully inclosed apparatus as a protection from accidental contact with live metal parts by requiring protection in design or location. The 15-amp. maximum fusing of branch circuits was continued as no demand developed for a change. The use of bare wire in Article 9, "Grounding," is permitted for a ground when the grounding conductor is in a conduit and bonded to the ends of the conduit. Similarly, for the grounding of equipment the grounded conductor may be of copper or other metal that will not corrode excessively under the existing conditions. In another rule the minimum size of grounding pipe permitted is given.

Methods of polarity identification of wiring and methods of supporting fixtures were described in Article 14, "Fixtures, Lamp Sockets and Similar Fittings." The rule for the grounding of fixtures was changed to require grounding under one or two more conditions than are now required. In Article 16, "Heating Appliances," the remote control of the switch of a range is permitted if desired. Some changes were made in Article 37, "Radio Equipment," as the result of the technical sub-committee study. The most striking change was the requirement of the fusing of both "A" and "B" batteries with not more than a 15-amp. fuse at or near the batteries.

As the result of a practical difficulty, Article 39, "Theaters, Including Motion-Picture Houses," was changed so that exit lighting is to consist only of all the lights necessary properly to illuminate the lobbies and other portions to which the public has access. Action on the use of lightning arresters in Article 40, "Small Isolated Plants," was deferred for further study before adoption. In Article 50, "Systems and Voltages Over 600 Volts," a new provision was made recognizing the use of static condensers as equipment. For the first time something specific and helpful has been incorporated in this article regarding the safeguarding of high-tension lines entering properties other than those of the central-station company.

Business Conditions

ORDERS being received by electrical manufacturers both from central-station companies and industrial firms are slowly gaining. Motor sales are improving, and business in small motors and starting equipment is very active. Utilities are placing good orders for line construction material considering the period of the year. Present orders cover only current requirements, and there does not appear to be any attempt to take care of future needs. Sales of electric control apparatus for the past ninety days are reported by one manufacturer as exceeding the average of the previous six months by 33 per cent. The greatest percentage of increase is being shown in sales of automatic equipment. One fuse manufacturer also reports very good business in both refillable and non-refillable fuses. Inquiries in increasing number are being received by manufacturers, and conditions look better all the time.

Current market conditions are very aptly described by the National Bank of Commerce in New York as follows: "The spirit of artificial optimism so much in evidence a few weeks ago has been largely eliminated and the outlook today is satisfactory for all except those whose only idea of good business is the promise of speculative profits." The average output of the steel industry is now up to 88 per cent, spring orders having increased the volume of business.

In New England a very good increase is reported in the sales of small motors, and a good volume of business is being transacted with the textile, metal and shoe industries. Sales to central-station companies are improving in the New York district, and many inquiries for quotations are being received by manufacturers of switching equipment, transformers, pole-line construction material, etc. Sales of small general-purpose motors and starting equipment are active in that territory. In the Southeast central-station buying is active, and there has been a reasonable increase in the demand for industrial motors. Better business is generally manifested throughout the middle Western territory, purchases by industrial firms have improved, and construction work by utilities has increased. On the Pacific Coast business has been quieter. Plenty of snow in the Sierras will prevent any water shortage for hydro-electric plants in that section.

Prices of Non-Ferrous Metals Steady—Market Quiet

PRICES of the non-ferrous metals have held steady here but have advanced slightly in London. The market has been very quiet. None of the producers seem very anxious to sell since they feel that as long as the foreign market holds up they will lose nothing by waiting until consumers again enter the market. All of the copper sold in the East since last week Thursday has brought either 14⅝ cents or 14¾ cents delivered, with 14¾ cents secured on some business in the Middle West. Most of the sales made were the result of an active canvassing of prospects by producers. Brass companies were the chief buyers, but the total volume of sales was small. The export market was also very quiet.

The American Smelting & Refining Company's contract price for lead remained at 9¼ cents. One small producer sold a few hundred tons at 8⅞ cents, but most sales were at the contract price. Trading was dull and in small lots for immediate shipment. Zinc has advanced somewhat in price. Producers are in no mood to make reductions as long as the present prices for ore continue. The rise in foreign prices for zinc are encouraging, though the demand there has not amounted to much. Tin has been remarkably steady. Most of the business has been between operators, but consumers picked up a little of the metal on Tuesday, when the price weakened slightly from early quotations.

NEW YORK METAL MARKET PRICES

	Feb. 18, 1925 Cents per Pound	Feb. 25, 1925 Cents per Pound
Copper, electrolytic	14⅞	14⅛–14¼
Lead, Am. S. & R. price	9¼	9¼
Antimony	21⅛	20
Nickel, ingot	31	31
Zinc, spot	7.75–7.80	7.85–7.90
Tin, Straits	57	57
Aluminum, 98 to 99 per cent	28	28

Motor Sales Show Encouraging Trend in New England District

INQUIRIES for quotations on small motors as well as sales throughout the New England district indicate an encouraging trend toward a very good year. One prominent manufacturer reports an increase of over 50 per cent in small motor sales in New England for the first six weeks of 1925 as compared with a similar period in 1924. In the textile, metal and shoe industries a good volume of business is under way. The woodworking interests are gradually motorizing and are in the field for small power units. One New England manufacturer reports a steady growth in sales of small motors on the West Coast.

There is a good demand for switches and insulators. One jobber closed a sale for two cars of weatherproof line wire and predicts increasing activity in high-tension line-wire sales. Two central-station companies in small Massachusetts cities record eighty-two kitchen-unit sales for the week, and a well-known vacuum cleaner company announces 153 sales in Worcester for the same period, though, in general, jobbers report a slackening up in sales in domestic appliances. On the other hand, the central-station company sales are very encouraging, fourteen stations showing appliance sales to date amounting to $76,238 for the week ending February 14, as compared with $45,845 for a similar period in 1924. An upward trend in the sale of automobiles has reflected a good demand for batteries, ignition and wiring devices and is stimulating interest in dynamometers and attached power units, one of the latter having been purchased by the Fisk Tire Company of Boston.

Central-Station Buying Active in the Southeast

CENTRAL-STATION purchases continue to be the main feature in the Southeast, the most notable orders received during the past week being for six 2,000-kva. and two 1,667-kva. transformers from one company and one order for $15,000 worth of poles and pole-line materials. During the past month one company alone has purchased 675 miles of transmission cable. Generally speaking, the electrical jobbing business has been rather slow this past week, though the heavy building program under way in the Birmingham district and sections of Florida is serving to hold up the volume of construction-material sales.

A reasonable increase in the demand for industrial motors is reported, with prospects for a marked activity between now and midsummer. Retailing is reported slow, though campaigns on vacuum cleaners in a number of centers have stimulated sales of this item in the past ten days. Farm-lighting-outfit sales are at a low ebb, and there are little prospects for a quick pick-up. Indications are for an early spring, and, judging from the number of fan contracts signed to date, this year will set a new high record for fan activities. Municipal lighting is occupying a prominent position at this time, with an unusual amount of interest displayed in ornamental street and highway lighting and improved traffic signal lighting, Atlanta having recently adopted the synchronous traffic signal system, which will be installed throughout the entire business district as soon as possible. Radio business is slow. Two of the larger Southeastern power companies have recently announced the entrance into the radio merchandising field of their retail properties.

Better Business in Middle West—Maintenance Purchases High

BETTER business is generally manifested throughout the Middle Western territory. The first half of the month was admittedly a trifle slow, while indications point now to a satisfactory closing of the month. Increasing purchases by industrial firms, together with more active construction by the various utilities, tend to swell the volume of business. Maintenance purchases have been rather heavy, with such items appearing as approximately $60,000 worth of turbine blading material and storage-battery renewals valued at $80,000.

Transformers (distribution and current types), cable and insulators were more noticeably in demand, and sales of pole-line hardware were good. The addition of many industrial manufacturers to the lines of utilities has increased the power load materially. Electric truck sales have been excellent. One utility purchased fourteen such

trucks recently. Marked activity is reported by a manufacturer of universal-type and 32-volt motors. Jobbers have had a good week. The volume of business has not been up to the previous month, but it is expected that the month will close well. Appliances, particularly washing machines, have had a ready sale, and other appliances have been in good demand. Prices remain virtually the same, except that lead-covered code wire was increased somewhat this week and there have been some minor changes in the prices of wiring devices.

Good Demand for Motors in New York District

THERE is a good demand in the New York district for motors of the smaller sizes and motor-starting equipment. A number of inquiries are being received by manufacturers from central-station companies and industrial firms. The interest of utilities in 220-kv. air-break switches has caused all companies making this class of equipment to prepare switches for this service, and manufacturers are striving to obtain the best results. An order for $40,000 worth of miscellaneous switching equipment was recently placed by a utility company and follows an order previously placed by the same company for about the same amount of oil breaker equipment.

Orders for pole-line hardware are being received in better volume, and more quotations are being received than is usual at this period of the year. Prices have not changed, although there have been rumors to that effect. Orders are well distributed among various utilities which are only purchasing for current requirements with no effort to fill future needs in advance.

Business Quieter on Pacific Coast —Water Shortage Unlikely

BUSINESS has been somewhat quieter on the Pacific Coast. Heavy rains have postponed much construction, but there is an encouraging volume of building permits. There is 78 in. of snow at the summit of the Sierras, which is double the height reported one month ago, so that the big 1925 programs of the power companies will certainly not be hampered by water shortage. Recent pole-line-hardware business included 10,000 braces and 5,000 guy clamps with exceedingly intensive competition.

Several large industrial plants have been recently rewired, including a tannery and cement works. Coast stocks of wiring devices are high, having been accumulated in expectation of a big spring volume, but their present movement is slow. New wiring ordinances are creating a change in the type of sign receptacles. There is a growing demand for bakelite plates and plugs and fancy-colored round ball lamps that is also influencing local stocks. Collections have slightly slowed up because of a rather quiet month, and are now averaging about fifty-two days. New apartment houses under construction and nearing completion in Seattle are being equipped with electric ranges. Between 600 and 750 will have been installed by June 1.

Activities of the Trade

Allis-Chalmers Receives Turbine and Generator Orders

The Allis-Chalmers Manufacturing Company, Milwaukee, has received an order from the Puget Sound Power & Light Company, Seattle, for two 20,000-hp. horizontal-shaft, double-overhung Francis turbines for operation at 200 ft. normal net head at 300 r.p.m. for the Baker River plant. Controlling the turbines are two oil-pressure governors also of Allis-Chalmers manufacture. Water will enter the turbines through 84-in. butterfly valves also supplied by that company. A 720-hp. turbine is being supplied for use in connection with an exciter set.

An order has also been received by the company for two 5,000-kva. generators with direct-connected exciters for the Gem Irrigation District of the United States Reclamation Service at the Black Canyon Dam on the Payette River near Emmett, Idaho.

American Engineering Presents Service Emblems to Employees

The American Engineering Company, Philadelphia, manufacturer of Taylor stokers, recently presented diamond service emblems to thirty-two employees who have been with the company for twenty-five years or more. Gold emblems were presented to 275 other employees with records of from five to twenty-five years' service. Heading the list of those who received diamond emblems were two machinists with records of forty-six and forty-five years' active service respectively. Both are employed daily in the shops of the company.

Railway & Industrial Engineering Receives Order for $40,000

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission, switching and protective equipment, has received an order from the Public Service Production Company, Newark, N. J., for miscellaneous 37,000-volt switching equipment amounting to approximately $40,000. This apparatus is for use in various substations of the Public Service Electric & Gas Company.

Puget Sound Company Places Orders for Equipment

The General Electric Company has received an order from the Puget Sound Power & Light Company, Seattle, Wash., for two 19,500-kva., 6,600-volt, three-phase, 60-cycle horizontal generators. The company has also received an order for seven 6,667-kva. transformers for use with the generators. This equipment will comprise the first unit of the Baker River plant.

The Westinghouse Electric & Manufacturing Company has also received an order for one 500-kw. motor-generator set and another 500-kw. generator to be used with a hydraulic turbine. These units will be used for excitation.

De Laval Announces Change in New England Representation

Since January 15 all products of the De Laval Steam Turbine Company, Trenton, N. J., and the De Laval Separator Company, Poughkeepsie, N. Y., including turbines, centrifugal pumps, speed-reducing gears, oil purifiers, etc., will be handled exclusively in New England by the Turbine Equipment Company of New England, Chamber of Commerce Building, 80 Federal Street, Boston, F. R. C. Boyd, who for fifteen years has been connected with the Power Equipment Company, the former representative, is president of the new Turbine Equipment Company.

The Woodward Governor Company, Rockford, Ill., has just shipped three actuator-type governors for a hydro-electric installation in France. These governors are to control the speed of 11,000-hp. vertical-shaft turbines coupled direct to alternating-current generators. These units are to furnish power for the Paris-Orleans Railway, which is being electrified.

The Westinghouse Electric & Manufacturing Company announces that the office of its president, E. M. Herr, has been moved to New York and will be permanently located at the Westinghouse Building, 150 Broadway.

The Liberty Gauge & Instrument Company, 6612 Euclid Avenue, Cleveland, manufacturer of electrical specialties and household and heating appliances, announces that it has placed on the market a new toaster known as the "Liberty Flopper." This toaster is completely equipped with coaster feet, 6 ft. of extension cord and a standard two-piece separable plug to sell at a suggested retail price of $2.85.

The Electrical Appliance Manufacturing Company, Waterbury, Conn., is said to be planning for the early rebuilding of the portion of its plant destroyed by fire February 13, with a loss estimated at $40,000, including equipment.

The American Cross Arm & Conduit Company, 332 South Michigan Avenue, Chicago, will soon begin the erection of a new branch plant on Campbell Avenue, Kansas City, Mo., 110 ft. x 112 ft.

The Freed-Eisemann Radio Corporation, Sperry Building, Brooklyn, announces that it will soon erect in the vicinity of Long Island City a large modern radio factory. The company states that its sales in the last quarter of 1924 were more than $2,000,000.

The George W. Dunham Corporation, Utica, N. Y., announces its new "Dunham Whirldry" washer as the first unit of a line of electrical labor-saving appliances. This washer is of the centrifugal drying type.

New Trade Literature

REFLECTORS.—Catalog No. 25 issued by the Reflector & Illuminating Company, 565 West Washington Boulevard, Chicago, describes and illustrates its new "Sterling" silvered glass reflectors for show windows, showcases, floodlighting, cove and general interior illumination. Instructions are given for calculating illuminating intensities used in various classes of window displays and suggestions are offered for installation of reflectors. Attention is also called to its "Ready-2-Install" system of wiring for interior lighting, which is particularly adapted for wiring in display windows.

INDUCTION-TYPE OVERCURRENT RELAYS.—Bulletin No. 47,640.2 issued by the General Electric Company, Schenectady, N. Y., describes four types of overcurrent relays, together with the application of each. Details of construction, list of available ratings and principles of operation are given, including illustrations showing the characteristics and features of the various types of relays.

BAKELITE.—"The Material of a Thousand Uses" is the title of a booklet issued by the Bakelite Corporation, 247 Park Avenue, New York City, in which it describes and illustrates the many uses for "Bakelite." Attention is also called to the various uses in which "Bakelite" in liquid form can be applied.

STOKERS.—"A Type for every Stoker Need" is the title of a booklet issued by the Riley Stoker Corporation, 9 Neponset Street, Worcester, Mass., covering its various types of stokers, including the Riley superstoker, Riley standard stoker, "Lateral Retort" stoker, Jones "A-C" stoker, Jones "Side-Dump" stoker, Jones "Standard" stoker, "Industrial Furnace" stoker, Murphy automatic furnace and the Harrington traveling-grate stoker. Illustrations are given showing various installations of the stokers.

OIL SWITCHES AND CIRCUIT BREAKERS.—The Condit Electrical Manufacturing Company, South Boston, Mass., has issued bulletin No. 423-3, covering its type "Y" line of oil switches and circuit breakers for manual and electric remote control, automatic or non-automatic, and bulletin No. 456-2, describing its electrically operated mechanism for automatic closing and reclosing of oil switches and circuit breakers, indoor or outdoor service, by direct or alternating current.

AUTOMATIC STARTERS.—Bulletin No. 219 issued by Crocker-Wheeler Company, Ampere, N. J., describes and illustrates the new Crocker-Wheeler automatic remote-starter for alternating-current squirrel-cage motors. The method of installing is illustrated, and attention is called to the ease of renewal contacts.

RECORDING INSTRUMENTS. — The Uehling Instrument Company, Paterson, N. J., has issued bulletin No. 118, covering the "Apex" CO_2 recorder, and bulletin No. 118-A, describing the principle of operation of the "Apex" pneumatic recording and indicating CO_2 meter.

COMBINATION GRINDERS AND BUFFERS.—The Hisey-Wolf Machine Company, Cincinnati, is distributing bulletin No. 1,582, describing four new types of the "Hisey" motor-driven combination grinding and buffing machines, which are made in ½-hp. and 1-hp., sizes with open and incased spindle extensions.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Belgium (No. 13,838) of radio sets and parts.

Purchase is desired in Canada (No. 13,840) of electric flashlights and electrical novelties.

Purchase is desired in France (No. 13,784) of lubricating oils. (No. 13,841) of scientific instruments.

Purchase is desired in Rumania (No. 13,823) of refrigerating plants and ice-making plants.

Purchase is desired in South Africa (No. 13,824) of radio sets and parts.

Purchase is desired in Venezuela (No. 13,825) of electric signs, letters, flashes and insulated wire.

An agency is desired in England (No. 13,788) for dairy machines and accessories, especially cream separators. (No. 13,827) for domestic appliances, lighting fixtures and wiring supplies.

An agency is desired in Germany (No. 13,785) for lubricating oils.

An agency is desired in Spain (No. 13,826) for radio sets and parts.

New Incorporations

THE CENTRAL VIRGINIA POWER COMPANY, Roanoke, Va., has been chartered with a capital stock of $5,000,000. The officers are: Frank W. Rogers, president; C. B. Short, secretary; Joseph H. Chitwood, Leonard G. Muse and W. H. Horn, directors, all of Roanoke.

THE FLORIDA POWER COMPANY, St. Petersburg, Fla., has been incorporated with a capital stock of $1,000,000. The company will take over the properties of the Florida Power Company of Ocala, including a hydro-electric plant on Withlacho River, south of Dunnellon, which supplies Dade City, Zephyr Hills, etc., and also 200 miles of transmission lines. I. C. Ervin is vice-president and John D. Harris, 135 Sixth Avenue, St. Petersburg, is secretary.

THE SOUTHERN VIRGINIA POWER CORPORATION, Martinsville, Va., has been incorporated with Whiting C. Faulkner, president, and Edmund M. Preston, secretary.

THE HYDRO-ELECTRIC CORPORATION, Rogersville, Tenn., has been incorporated with a capital stock of $40,000 by George D. Hale and Philip H. Riley.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LOWELL, MASS.—The Lowell Electric Light Corporation has awarded Stone & Webster Company, Boston, a contract for extensions to its Perry Street steam-driven station. The work will include the installation of a 12,500-kw. turbo-generator, equipped with surface condenser, etc., addition to turbine room and augmenting the condenser circulation by additional tunnels. The electrical switchboard will be consolidated.

BRIDGEPORT, CONN.—The American Tube & Stamping Company, Hancock Avenue, plans to build a substation for plant service; also three one-story motor and switch buildings, which will require considerable additional electric power equipment.

MERIDEN, CONN. — The Stewart-Warner Speedometer Corporation, 1826 Diversey Boulevard, Chicago, Ill., plans to install electric power equipment at its proposed local factory for the manufacture of speedometers, oil pumps, etc.

Middle Atlantic States

BEAVER DAMS, N. Y. — The Beaver Dams Light & Power Company has been granted permission to erect an electric distributing system in the towns of Dix and Orange and Catlin and to exercise franchises granted by the town boards.

BUFFALO, N. Y.—Bids will be received by the Superintendent of Lighthouse, Buffalo, until March 9 for furnishing approximately 17,000 ft. of armored submarine cable.

ITHACA, N. Y.—The City Council has authorized the City Manager to advertise for bids for installing an ornamental lighting system on several streets, to cost about $10,000.

ROCHESTER, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until March 4 for two electric dumbwaiters for the Rochester State Hospital.

SCHENECTADY, N. Y. — Plans have been announced by the Adirondack Power & Light Company for the construction of a substation at Rosa Road and Hillside Avenue and the erection of a service loop around Schenectady during the summer. The cost is estimated at $100,000.

SWEDEN, N. Y.—The Western New York Utilities, Inc., Watertown, has petitioned the Public Service Commission for permission to extend its electric distribution system to Sweden to furnish electricity here. Sweden has no post office.

HARRISON, N. J.—The Public Service Electric & Gas Company, Newark, plans to install four 600-hp. boiler units with chain-grate stokers, turbine-driven forced-draft fans, etc., in connection with its proposed local boiler plant. The Public Service Production Company has charge of the work.

MERCER, PA.—Extensive improvements are contemplated by the Mercer County Light & Power Company, Greenville, to its local system, which will include the construction of a new substation and the erection of a high-tension transmission line from the Greenville plant.

BLUEFIELD, W. VA.—Surveys are uder way by the Appalachian Power Company for extension to its transmission lines from Roanoke to Martinsville, thence to Danville and the Carolina line, a distance of about 75 miles.

HUNTINGTON, W. VA.—Bids will be received by the United States Engineer until March 4 for one 3-kw. belt-driven electric generator set, one oil engine and one single-stage, straight-line air compressor (Circular 94).

LYNCHBURG, VA.—Work has started by the Lynchburg Traction & Light Company on the erection of a 132,000-volt transmission line from the coal fields of West Virginia to Lynchburg. The company is also building additions to its hydro-electric plant at Reusens and its local steam station.

WASHINGTON, D. C.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, for switchboard and changes in electric wiring at the Washington medical school, naval hospital (Specification 5079).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until March 13 for electrical fixtures, wire, fans, resistance units, outlet boxes, transmitter mouthpieces, etc. (Panama Circular 1657).

North Central States

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 6 for underground cable for installation of flashlight recall system for the Fourteenth Precinct.

NILES, OHIO.—The City Council has authorized the water and light committee to secure details and estimates of cost of a municipal electric light and power plant.

PIQUA, OHIO.—Bids will be received by the Director of Public Service until March 10 for a filtration plant, including a low-service pumping station, water purification and softening plant combined with a high-service pumping station. William G. Clark, Spitzer Building, Toledo, and Charles P. Hoover, 186 West Spring Street, Columbus, are consulting engineers.

TIFFIN, OHIO. — The American Clay Forming Company plans to build a power house in connection with the rebuilding of its plant, recently destroyed by fire.

LOUISVILLE, KY. — The Louisville Hydro-Electric Company, a subsidiary of the Louisville Gas & Electric Company, has acquired a site in Shippingport, a section of Louisville, for a proposed new hydro-electric power station at the Falls of the Ohio River.

CULLOM, ILL. — The plants and the holdings of the Cullom Electric Company have been acquired by the Central Illinois Public Service Company. Extensions and improvements are contemplated by the new owner.

APPLETON, WIS.—Extensions and improvements involving an expenditure of about $400,000 are contemplated by the Wisconsin Traction, Light, Heat & Power Company. The work will include replacing four boilers in its steam-power plant with four boilers equipped with furnaces burning pulverized coal, new stoker equipment and installing forced-draft fans. An addition to the power house will be built to house the machinery for pulverizing coal and a 225-ft. smokestack will be erected.

BAYFIELD, WIS.—The City Council has decided to discontinue the operation of the municipal electric plant and proposes to secure energy from the transmission line of the Northern Wisconsin Hydro-Electric Company, Port Wing, from Orienta Falls.

GREEN BAY, WIS.—The erection of a transmission line from Institute to Valmy is under consideration by the Wisconsin Public Service Corporation to supply electricity in those towns.

PESHTIGO, WIS.—The Wisconsin Public Service Corporation, Oconto, has purchased the partly developed Potato Rapids power site, located about 4 miles from Peshtigo, from the Peshtigo Pulp & Paper Company. The new site, it is estimated, will develop about 2,000 hp.

FERGUS FALLS, MINN. — Extensions contemplated by the Otter Tail Power Company include the construction of a power plant and dam at Friberg, near Fergus Falls.

HIBBING, MINN.—Bids will soon be asked by the City Council for extensions in the municipal electric plant and installation of a new generating unit to cost about $350,000. R. D. Thomas, 1200 Second Avenue, Minneapolis, is engineer.

MINNEAPOLIS, MINN.—The installation of a new ornamental lighting system on Minnehaha and St. Anthony Boulevards, to cost about $200,000, is under consideration by the Board of Park Commissioners. Charles E. Doell is secretary.

MADRID, IOWA.—The Town Council is considering the installation of an ornamental lighting system in the business district.

SIOUX CITY, IOWA.—The City Council is considering the installation of an ornamental lighting system on West Seventh Street from Pearl to Center Street, to cost about $10,000.

KANSAS CITY, MO.—Bids will be received by A. J. Stewart, purchasing agent of Kansas City, City Hall, for filtration plant, pumping station, pressure tunnel, etc., including pumps, motors and equipment for additional water supply works as follows: Until March 18 for Contract 7, including two 24,000,000-gal.-daily-capacity centrifugal pumps without motors; eight 35,000,000-gal.-daily-capacity centrifugal pumps without motors; three 2,500-g.p.m. centrifugal pumps with motors, two 500-g.p.m. centrifugal pumps with motors, two 250-g.p.m. centrifugal pumps with motors, and for erecting all of the above pumps and motors, the motors to be furnished under Contract 8, which includes two 2,000-hp., eight 400-hp. synchronous motors and five 30-kw. motor-generator sets. Contract 9—for three switchboards and appurtenances. Contract 10—for one outdoor substation. Bids will be received until March 21 for Contract 12 for construction of a filtration plant consisting of twenty-four 4,000,000-gal.-daily-capacity units with filtered-water basin beneath of a capacity of 2,250,000 gal.; a secondary pumping station designed for five 35,000,000-gal.-daily-capacity electric motor-driven units, a chemical house for storing and applying chemicals, equipped for the manufacture of alum and housing a central heating plant; a chlorine house, together with all appurtenances, except main pumping units, valves, cast-iron pipe, switchboard and other electrical apparatus, which will be furnished under other contracts, but, all except main pumping units, set under this contract. Fuller & Maitland, 600 Walnut Street, are engineers. Drawings and specifications are on file at the offices of the Board of Fire and Water Commissioners, Fuller & Maitland, engineers, 600 Walnut Street, Kansas City, and Fuller & McClintock, 170 Broadway, New York City.

MEXICO, MO. — Contracts have been awarded by the Missouri Power & Light Company for the erection of a 33,000-volt transmission line connecting the present transmission line with the power plant of the Mississippi River Power Company at the Keokuk Dam, a distance of 30 miles. A large substation will be built at the dam to charge the frequency from 25 cycles to 60 cycles and to raise the voltage from 13,200 to 33,000.

OREGON, MO.—The St. Joseph Transmission Company is erecting a 11,500-volt transmission line from its substation in North St. Joseph 15 miles east and north to Cosby. On the completion of this line the company proposes to extend its system further on east and north into Dekalb and Andrew Counties.

DRAKE, N. D.—The Western Light & Power Company, Denver, which recently purchased the plant of the Drake Electric Company, contemplates erecting a transmission line from Washburn, to furnish a twenty-four-hour service here.

ATKINSON, NEB.—The Tri-State Utilities Company, Minneapolis, Minn., has acquired the system of the Atkinson Milling & Light Company. Extensions and improvements are contemplated, including the construction of a transmission line from Creighton.

FAIRBURY, NEB. — The City Council has issued $72,000 in bonds, the proceeds to be used for extensions and improvements in the municipal electric plant and waterworks.

ROSALIE, NEB.—At an election to be held March 17 the proposal to issue $17,000 in bonds for the erection of a new transmission line and for repairs to the electrical distribution system will be submitted to the voters. Grant, Fulton & Letton, 525 South Thirteenth Street, Lincoln, are engineers.

Southern States

ELIZABETH, N. C.—Bids will be received by W. Ben Goodwin, chairman of Utilities Commission, until March 18 for furnishing materials, construction of three systems of sanitary sewers, including six vertical low-speed sewage-pumping units complete with motors, starters, shafting, etc., and construction of three pumping stations. William C. Olsen, Raleigh, is engineer.

WILMINGTON, N. C.—Steps have been taken by the South Washington Street Property Owners' Association to secure an ornamental lighting system on that thoroughfare.

SPARTANBURG, S. C.—Work will soon begin on the construction of a large substation at East Spartanburg, to cost about $2,000,000, for the South Carolina Gas & Electric Company, which will replace a small station now being operated there and will be linked with the 15,000-kw. steam plant at Parr Shoals. The W. S. Barstow Management Association, Inc., 50 Pine Street, New York City, will be in charge of the work.

ST. AUGUSTINE, FLA.—Bids will be received by the City Commission until March 23 for improvements to the waterworks system, including construction of reservoir, pumping station, pumping equipment, etc. Joe E. Craig, 427 King Street, Jacksonville, is consulting engineer. Eugene Masters is city manager.

BIRMINGHAM, ALA.—The Public Service Commission has approved the sale of the properties of the Georgia-Alabama Power Company, Albany, and the Georgia-Alabama Utilities, Inc., operating in a number of southeast Alabama Towns to the Gulf Electric Company, a subsidiary of the Alabama Power Company, Birmingham. It also authorized the Gulf Electric Company to issue $874,000 in capital stock, of which $500,000 is to be used for the purchase of the above properties and the remainder $226,000 to be used for transmission lines, extensions and improvements.

MONTICELLO, ARK. — The Arkansas Light & Power Company, Pine Bluff, has acquired the municipal electric power plant and plans extensions in the transmission system in this section.

BATON ROUGE, LA.—Contract has been awarded by the Baton Rouge Electric Company to Stone & Webster, Inc., Boston, for extensions to its plant. The work will include an addition to power house and installation of a 3,500-kw.turbo-generator and auxiliaries. The existing spray pond will be enlarged, but no addition to boiler capacity is necessary.

GRETNA, LA.—The City Council is considering calling an election to submit the proposal to issue $160,000 in bonds for the construction of an electric light plant.

HINTON, OKLA.—The City Council has plans under way for extensions and improvements in the municipal power plant and system to cost about $20,000. O. C. Benham, Kansas City, Mo., is engineer.

CELESTE, TEX.—The system of the Celeste Light & Power Company has been acquired by the Southwestern Power & Light Company, 71 Broadway, New York City.

WELLINGTON, TEX. — The Common Council has authorized plans for extensions and improvements in the municipal electric plant. V. V. Long & Company, Colcord Building, Oklahoma City, Okla., are engineers.

Pacific and Mountain States

HANFORD, WASH. — Application has been filed with the Federal Power Commission by the Inland Power & Light Company, Portland, Ore., for a license to erect a transmission line in Franklin County, to be known as the Hanford-Taunton line.

TACOMA, WASH.—Bids, it is reported, will soon be asked by the Commissioner of Light and Water for 32,000 ft. No. 4/0 aluminum wire, and 32,000 ft. No. 2/0 copper wire.

ST. HELENS, ORE.—Plans for the proposed local paper mill to be erected jointly by W. P. Hawley, president of the Hawley Pulp & Paper Company, Oregon City, and Charles R. McCormick, head of the McCormick Lumber Company, St. Helens, to cost about $1,500,000, include a power plant.

BERKELEY, CAL. — The City Council has authorized the installation of an ornamental lighting system on Center Street from Shattuck to Piedmont Avenue.

HEROULT, CAL. — The Pacific Gas & Electric Company, San Francisco, is planning to expend about $21,840 for the reconstruction and standardizing its power lines in the vicinity of the Shasta Iron Company and the Shasta Zinc & Copper Company, and also to install a 60,000-volt substation at Bully Hill and Heroult to supply these companies with additional service.

LOS ANGELES, CAL.—Plans have been approved by the Municipal Art Commission for ornamental lighting systems, to cost about $446,000.

LOS ANGELES, CAL.—Application has been filed with the State Division of Water Rights by Charles A. Giffen, H. Knapp, O. E. Freeman, P. W. Porter and R. V. Pearsall, all of Los Angeles, for a permit to divert water from the East and North Forks of the Trinity River. The project includes the construction of a reservoir with a capacity of 170,000 ft. of water and a hydro-electric plant to develop power for mining, pumping and industrial purposes. The cost is estimated at $6,000,000.

LOS ANGELES, CAL.—Extensions and improvements are contemplated by the Southern California Edison Company in various districts during 1925 as follows: In the San Bernardino district, $200,000; Hanford district, $150,000; Long Beach district, including enlargement of six local substations, $1,000,000; in Huntington Beach, $350,000, and the Vernon district, which includes Maywood, Vernon, Huntington Park, Bell, Walnut, South Gate and intervening territory, $750,000.

ROSEVILLE, CAL.—The Pacific Gas & Electric Company, San Francisco, is considering construction of a new local substation to cost about $125,000.

SANTA BARBARA, CAL.—The Santa Ynez Valley Irrigation District plans to build a power plant and substations in connection with a proposed irrigation project, to cost about $2,000,000. H. H. Henderson, Mihran Building, Santa Barbara, is interested in the project.

IDAHO FALLS, IDAHO. — Plans are under consideration by the Idaho-Montana Asbestos Company for the construction of a 1,200-hp. electric power plant on the Madison River in Madison County, Mont., in connection with a proposed new mill, to cost about $400,000. E. R. South and Carl W. Peterson, both of Idaho Falls, are interested in the project.

LEWISTON, IDAHO.—The Weyerhouser Timber Company, Tacoma, Wash., is planning the construction of a power plant at its proposed local lumber mill, to cost about $1,500,000. It will be known as the Clearwater Timber Company, now being organized as a subsidiary.

ALBUQUERQUE, N. M.—The Gilliland Oil Company, Tulsa, plans to build an electric power plant in connection with a proposed local oil refinery.

Canada

VANCOUVER, B. C.—Additional ornamental lamp standards will be installed on a number of streets, at a cost of about $72,000.

LEAMINGTON, ONT.—The installation of a new street-lighting system is under consideration, to be maintained by underground wires. The work will include from 1½ to 2 miles of underground conduit and cable and sixty lamp standards.

MANIWAKI, QUE.—Bonds to the amount of $350,000 have been issued by the Gatineau River Power Company, recently incorporated, to take over the property of the Maniwaki Electric Company, Ltd., which supplies electricity in the Gatineau Valley, particularly in Maniwaki and surrounding district, and also a telephone system, consisting of 200 miles of line, which serves this district and connects the valley with Ottawa. The proceeds will be used to complete the purchase of the system, build over 50 miles of transmission lines, extension to telephone system and to complete the development of 2,500 hp. at the present plant.

MONTREAL, QUE. — The Canadian Paperboard Company, 2 Seigners Street, is planning to build a 400-hp. steam-power plant. Kerry & Chace, Ltd., Confederation Life Building, Toronto, engineers.

QUEBEC, QUE.—Notice has been filed with the Minister of Lands and Forests by Price Brothers & Company of their intention to build a dam on that part of the Saguenay River known as Little Discharge in the village of St. Joseph d'Alma.

Electrical Patents

Announced by U. S. Patent Office

(Issued February 3, 1925)

1,524,876. HOLDER FOR TERMINALS OF VIOLET-RAY APPARATUS; T. Mueller and T. S. Lorenze, Chicago, Ill. App. filed Sept. 8, 1922.

1,524,899. MOTOR FRAME; W. J. Wise and T. O. Adams, New Philadelphia, Ohio. App. filed Nov. 23, 1921. For electric motors such as are used in suction cleaners.

1,524,900. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed Sept. 9, 1921. Private automatic exchange.

1,524,907. ARC-WELDING DEVICE; W. P. Bovard, Mansfield, Ohio. App. filed July 19, 1923. For rail bonding.

1,524,911. SWITCH; C. Christensen, Chicago, Ill. App. filed Nov. 20, 1920. Air-break type.

1,524,917. ELECTRIC PRESSING IRON; S. Desure, New York, N. Y. App. filed Sept. 8, 1924. In which the heating element forms a separate unit.

1,524,919. CIRCUIT-CONTINUING DEVICE; H. A. Douglas, Bronson, Mich. App. filed March 22, 1923. Shells for incandescent lamps as on automobiles.

1,524,930. AUTOMATIC SYSTEM OF CONTROL; R. V. L. Hartley, East Orange, N. J. App. filed Dec. 17, 1921. In the transmission of electrical energy for signaling and kindred purposes.

1,524,937. ELECTRODE FOR ELECTROLYTIC CONDUCTIVITY CELLS; E. A. Keller, Oak Lane, Pa. App. filed Jan. 10, 1924.

1,524,941. NON-ALIGNING TROLLEY HEAD; S. S. Matthes, Mansfield, Ohio. App. filed Sept. 20, 1921.

1,524,942. CURRENT COLLECTOR; S. S. Matthes, Mansfield, Ohio. App. filed May 11, 1923. Trolley harps.

1,524,948. FLASHLIGHT SIGN; B. R. Pallardy, St. Louis, Mo. App. filed Dec. 16, 1921. Having an electric circuit that is opened and closed by a switch under control of the belt of an automotive engine.

1,524,959. AUTOMATIC SOLENOID SWITCH; E. W. Way, Seattle, Wash. App. filed March 14, 1921. For continuously reciprocating solenoids as in sign flashers.

1,524,993. ELECTRIC HEATER; T. F. Meinhardt, G. I. Ray, and G. G. Ray, Charlotte, N. C. App. filed April 8, 1924. Heating coil disposed within a current of air, the heated air and heated element being within a closed casing.

1,525,014. CABLE AND BOX CONNECTOR; J. A. Volk, Jr., New York, N. Y. App. filed Jan. 4, 1921.

1,525,022. SPEED REGULATION OF POLYPHASE INDUCTION MOTORS; O. T. Bláthy, Budapest, Hungary. App. filed Dec. 19, 1921. By pole changing.

1,525,049. ELECTRON-DISCHARGE TUBE; S. Ruben, New York, N. Y. App. filed June 28, 1923.

1,525,053. PROGRAM TRANSMISSION OVER WIRES; J. F. Toomey, New York, N. Y. App. filed Nov. 11, 1922.

1,525,054. POWER AND AMPLIFYING EQUIPMENT FOR DISTRIBUTION OF INTELLIGENCE OVER WIRES; J. F. Toomey, New York, N. Y. App. filed Dec. 1, 1923.

1,525,058. WELDING ROD; F. M. Becket, New York, N. Y. App. filed Sept. 25, 1922. For welding and brazing of copper and copper alloys.

1,525,062. ARMORED CABLE WITH MULTIPLE CONDUCTORS; P. M. J. Boucherot, Paris, France. App. filed March 31, 1921. Subterranean cable for the distribution of single-phase or polyphase alternating currents.

1,525,096. PROCESS FOR SUPPLYING HEAT TO A METAL; B. M. S. Kalling, O. G. S. Anderson and S. D. Danielí, Trollhättan, Sweden. App. filed May 16, 1923. Electrically fusing a metal by forming part of the metal to be fused into an electrode.

1,525,110. AUDIO FREQUENCY-SELECTIVE SIGNALING SYSTEM; F. K. Vreeland, Montclair, N. J. App. filed Aug. 6, 1919.

1,525,129. DYNAMO-ELECTRIC STARTING, LIGHTING AND IGNITION MECHANISM FOR AUTOMOBILES; J. A. Heany, Jersey City, N. J. App. filed Aug. 1, 1910.

1,525,142. SNAP SWITCH; W. C. Miles, New York, N. Y. App. filed Dec. 12, 1922. As used in appliance cords.

1,525,176. ELECTRIC HEATING MEANS FOR OIL WELLS; J. S. Givens, Fort Worth, Tex. App. filed April 27, 1923.

1,525,177. DIRECT-READING RADIOTELEGRAPHIC COMPASS; R. B. Goldschmidt and R. Braillard, Paris, France. App. filed May 24, 1920.

1,525,179. MOTOR; W. H. Greenleaf, Hartford, Conn. App. filed July 10, 1922. Miniature type as used in the operation of a clock.

1,525,182. SOUND TRANSMITTER AND RECEIVER; H. C. Hayes, Washington, D. C. App. filed July 7, 1923.

1,525,183. RESISTANCE UNIT AND METHOD OF MAKING THE SAME; C. W. H'Doubler, Racine, Wis. App. filed Nov. 19, 1921. Adapted for use in connection with rheostats, lightning arresters or small devices requiring but moderate heat.

1,525,215. ELEVATOR SWITCH LOCK; F. Wolff, San Francisco, Cal. App. filed June 14, 1922.

1,525,229. MEANS FOR MOUNTING INSULATOR PINS; C. S. Cotton, Crafton, Pa. App. filed May 22, 1919.

1,525,257. TIME-CONTROLLED DEVICE; L. V. Stoeltzlen, Erie, Pa. App. filed Oct. 14, 1921. Time switch.

1,525,268. ELECTRICAL THERAPEUTIC APPARATUS; R. W. Chapman, Oldtown, Me. App. filed May 24, 1920. Of the tvpe adapted to produce a sinusoidal current.

1,525,271. ELECTROPLATING BARREL; J. T. Daniels, Newark, N. J. App. filed July 21, 1923.

1,525,277. WELDING TOOL; G. Dincognito, Chicago, Ill. App. filed Oct. 18, 1923.

1,525,282. WIRE-INSULATION TESTER; J. L. Entwistle, Central Falls, R. I. App. filed Oct. 15, 1921.

1,525,286. BATTERY-JAR-TESTING APPARATUS; J. R. Gammeter, Akron, Ohio. App. filed Dec. 7, 1920.

1,525,312. HAIR-CURLING DEVICE; H. E. Mikaelson, Chicago, Ill. App. filed May 7, 1923.

1,525,324. BATTERY SEPARATOR AND JAR; C. C. Rich, Mount Vernon, N. Y. App. filed Aug. 9, 1922.

1,525,350. VACUUM SPARK GAP; H. Zuckerman, New York, N. Y. App. filed Dec. 4, 1920.

1,525,388. ELECTRIC FLATIRON; W. T. Hoofnagle, Glen Ridge, N. J. App. filed Oct. 21, 1922. Fused, for preventing the iron from becoming dangerously overheated.

1,525,407. HIGH-VOLTAGE SWITCH; R. H. Marvin, East Liverpool, Ohio. App. filed June 1, 1921. Disconnecting switch for power lines of 100,000 volts or more.

1,525,431. REMOTELY CONTROLLED SELECTIVE SYSTEM; T. H. Phillips, Jr., Brooklyn, N. Y. App. filed Oct. 17, 1917. By means of a minimum number of line wires or by radiant energy.

(Issued February 10, 1925)

1,525,460. RESISTANCE; W. W. Miller, New York, N. Y. App. filed Feb. 13, 1922. Elements having insulating bases with which the resistor is associated by winding or otherwise.

1,525,474. SAFETY SWITCH; E. H. Thompson, Evanston, Ill. App. filed May 20, 1922. Snap switch.

1,525,508. ELECTRIC WATER HEATER; J. McCormick, Ottawa, Ontario, Canada. App. filed July 5, 1923. For domestic use.

1,525,512. PYROGRAPHIC INSTRUMENT; C. R. Post, New York, N. Y. App. filed Jan. 19, 1922.

1,525,518. METHOD OF MAKING CHROMIUM CONTAINING ALLOYS; W. H. Smith, Cleveland, Ohio, and C. M. Campbell, East Cleveland, Ohio. App. filed Sept. 11, 1922. Using an electric furnace.

1,525,522. PRINTING TELEGRAPHY SYSTEM; G. S. Vernam, Brooklyn, N. Y. App. filed Jan. 29, 1918. Auxiliary or "break-in" signals for use in connection with such system.

1,525,523. PRINTING TELEGRAPHY; G. S. Vernam, Brooklyn, N. Y. App. filed Nov. 21, 1921. Means whereby the system may be readily changed from full-duplex to half-duplex operation and vice versa.

1,525,526. RADIO RECEIVING SYSTEM; J. Weinberger, New York, N. Y. App. filed March 3, 1921. With means for eliminating interference.

1,525,529. METHOD AND APPARATUS FOR CONTROLLING DEVICES ACCORDING TO CONDITIONS OF LIGHT; F. L. Wiederhold, Plainfield, N. J. App. filed Aug. 1, 1922.

1,525,530. SAFETY VERTICAL BREAK SWITCH; E. E. Anderson, Chicago, Ill. App. filed May 20, 1922. For high-tension lines.

1,525,548. PNEUMATICALLY CONTROLLED LIGHT VALVE; C. F. Jenkins, Washington, D. C. App. filed Aug. 30, 1922.

1,525,549. RADIO PICTURE FREQUENCY CHOPPER; C. F. Jenkins, Washington, D. C. App. filed Aug. 30, 1922.

1,525,550. FLEXING MIRROR; C. F. Jenkins, Washington, D. C. App. filed Oct. 31, 1922. For receiving pictures by radio.

1,525,551. MAGNETICALLY SUSPENDED ARMATURE; C. F. Jenkins, Washington, D. C. App. filed Dec. 18, 1922. Apparatus for the broadcasting of radio pictures.

1,525,552. SQUARE SPOTLIGHT SOURCE; C. F. Jenkins, Washington, D. C. App. filed April 21, 1923. To be used with apparatus for sending photographs by radio.

1,525,553. DISTANT MOTOR CONTROL; C. F. Jenkins, Washington, D. C. App. filed April 21, 1923. For apparatus used in radio vision.

1,525,554. ELECTROLYTIC REFLECTOR; S. W. Jenks, Washington, D. C. App. filed Sept. 11, 1922. For the transmission of pictures by radio.

1,525,576. HEAT RADIATOR; H. P. Flickinger, Spokane, Wash. App. filed Aug. 8, 1923. Hot-water type.

1,525,624. ELECTRIC HEATING DEVICE; E. Suter, Milwaukee, Wis. App. filed June 4, 1923. Used as cigar lighter, etc.

1,525,625. METHOD OF ELECTRIC WELDING; A. C. Taylor, Warren, Ohio. App. filed Nov. 28, 1921. In uniting metal valve heads to metal stems.

1,525,626. ELECTRICAL WELDING MACHINE; A. C. Taylor, Warren, Ohio. App. filed Sept. 15, 1923.

1,525,656. OIL-WELL HEATER; C. L. Redfield, Chicago, Ill. App. filed Sept. 11, 1922.

1,525,686. REGULATING ARRANGEMENT FOR VARYING CIRCUIT TUNING IN ACCORDANCE WITH VARIATION IN FREQUENCY; M. Osnos, Berlin, Germany. App. filed Feb. 20, 1923.

1,525,689. COVER FOR ELECTRC CONDUIT OUTLET BOXES; J. T. Pearson and R. M. Olley, Syracuse, N. Y. App. filed April 17, 1922.

1,525,691. ELECTRIC MOTOR; G. G. Poth, Cincinnati, Ohio. App. filed Oct. 24, 1921. For use with portable tools such as drills, etc.

1,525,697. ELECTROMAGNET; E. R. Stoekle, Milwaukee, Wis. App. filed Dec. 26, 1919. Applicable to lockout switches.

1,525,703. ELECTRIC FURNACE FOR THE REFINING OF ZINC OR OTHER VOLATILE METALS; F. Tharaldsen, Christiania, Norway. App. filed Sept. 25, 1922.

1,525,744. ELECTRIC HEATER; A. Johnson, Oakland, Cal. App. filed Nov. 19, 1923. Conventional steam-radiator unit form, adapted to heat both by radiation and air circulation.

1,525,747. PLATE CONNECTOR FOR BATTERIES; C. Kinsley, Falls Church, Va. App. filed June 18, 1921. Prevents creepage of the electrolyte between adjacent cells.

1,525,759. STORAGE BATTERY; F. E. Pernot, Washington, D. C. App. filed Sept. 18, 1920. Portable type, electrolyte in colloid or jelly form.

1,525,780. MACHINE-SWITCHING TELEPHONE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed Nov. 3, 1919.

1,525,783. TELEDYNAMIC SYSTEM FOR GUIDE LIGHTS; A. D. Trenor, New York, N. Y. App. filed June 16, 1917.

1,525,787. TELEPHONE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Oct. 23, 1922. Co-ordinate machine-switching system.

1,525,802. ELECTRIC SWITCH; G. R. Dobbins, Alhambra, Cal. App. filed May 8, 1922. Of a type that, when open, is latched so that the switch cannot be accidentally closed.

1,525,818. ELECTRIC HEATING APPARATUS; A. Macha, Cleveland, Ohio. App. filed Dec. 9, 1922. For electrically heating articles to be welded or soldered together.

1,525,826. MOTOR-DRIVEN TOOL; D. Perlman, Los Angeles, Cal. App. filed Jan. 30, 1923.

1,525,827. PRODUCTION OF ALTERNATING CURRENTS; D. C. Prince, Schenectady, N. Y. App. filed Dec. 14, 1923. From direct current, using electron-discharge devices.

1,525,831. ELECTRICAL HEATING UNIT; L. E. Steiner and Floyd P. Smith, Bronx, N. Y. App. filed Oct. 20, 1923. Tubular resistance coil.

1,525,833. SELF-WINDING ELECTRIC CLOCK; U. L. Sundblad, New Haven, Conn. App. filed Aug. 11, 1924.

1,525,838. ELECTRIC RESISTANCE DEVICE; A. E. Waller, Bronxville, N. Y. App. filed March 14, 1921. Tubular unit covered with vitreous enamel.

1,525,840. ELECTRODE AND METHOD OF MAKING THE SAME; J. M. Weed, Schenectady, N. Y. App. filed May 26, 1920. Adapted for metallic-arc welding.

1,525,844. VACUUM-TUBE APPARATUS; W. C. White, Schenectady, N. Y. App. filed July 3, 1920.

1,525,851. STORAGE-BATTERY SEPARATOR; Pittsburgh, Pa. App. filed March 10, 1920.

1,525,888. ELECTRIC IRON; K. M. Raymond, Auckland, New Zealand. App. filed May 21, 1923. Means to prevent it from being left with the current on when not being used.

1,525,915. HEATING DEVICE; B. R. Charles, Los Angeles, Cal. App. filed Nov. 26, 1922. For automobile steering wheel.

1,525,931. SWITCH LOCK; E. L. Grauel, Cincinnati, Ohio. App. filed Feb. 10, 1923.

1,525,941. RADIO SIGNALING SYSTEM; C. V. Logwood, New York, N. Y. App. field April 21, 1920. For transmission.

Financial and Corporate

Utilities Drop, Then Rally

Many Leading Stocks Fall to New "Lows" for Year Before a General Recovery Starts

TRANSACTIONS in the power and light stocks during the week ended Saturday, February 21, or just prior to the holiday period, brought some interesting developments in prices. Numerous issues that generally are the most active fell to new "lows" for the year, the greatest weakness coming simultaneously with the weakness in listed stocks of other groups; but the dip to fresh low prices was quickly followed by substantial rallies. Several things have been mentioned as causes for the recent selling, but little has been said about one that appears to be increasing in importance — the possibility of tax reductions soon enough to affect 1925 income tax return. Traders with large paper profits have been more willing to take their profits as they have become convinced that the administration would go through with its tax program.

Perhaps the behavior of the utility markets of the week under review may best be illustrated by showing the movement of one of the leaders of the unlisted market, American Power & Light common. That stock earlier in 1925 sold as high as 67¼, but last week fell to 48½, a new "low" for the year, after which the stock closed the week around 56. On the week as a whole the price showed a gain of 3½ points, but to say that and nothing more would ignore the fact that in the same week a new "low" was established. That is about the history for the week of such other stocks as American Gas & Electric Company's common, Commonwealth Power Corporation, Electric Bond & Share Securities, Lehigh Power Securities and Middle West Utilities.

Commonwealth Power sold earlier in the year at 126¾, but last week sold as low as 108½ before it rallied to 115. Electric Bond & Share Securities Corporation has sold as high as 110 this year, but last week fell to a new record low of 56¼ before rallying.

Report of Toledo Edison

The annual report of the Toledo Edison Company, one of the chief public utility subsidiaries of the Cities Service Company, shows that in 1924 gross operating revenues increased to $8,015,230, from $7,491,890 in 1923, while gross income was $3,284,282, as compared with $3,083,442. There was a balance at the end of 1924 amounting to $1,946,249, as compared with $1,863,268 in the preceding year. The surplus credit balance as of December 31, 1924, was $5,868,443, as compared with $3,426,191 in the preceding year.

The number of customers served by the electric department of the company increased from 62,610 in 1923 to 75,285 last year

The report shows that the company reinvested a large amount of money in the property. The most noteworthy event of the year was the extension of the company's service through the acquisition of the properties of the Defiance Gas & Electric Company, the Swanton Light & Power Company and the Holgate Light & Power Company.

Company Reports

The following reports were issued during the past week for the month of January:

Name of Company	Gross Revenues for January 1925	1924
Adirondack Power & Light	$757,544	$661,922
Appalachian Power	336,578	307,615
Cities Service	1,670,453	1,400,611
Columbia Gas & Electric	2,777,726	2,976,772
Detroit Edison	*3,564,803	*3,364,833
East Penn Electric	294,435	309,281
Federal Light & Traction†	559,569	520,307
Great Western Power	711,407	650,741
Public Service Corp. of N. J.	8,594,657	7,815,207
Staten Island Edison	254,976	228,184
Virginia Railway & Power	932,460	925,884

* Includes other income. † December.

New Capital Issues

The largest piece of electric light and power financing during the past week was done by the Pennsylvania Power & Light Company in the form of first and refunding mortgage gold bonds totaling $8,000,000. The bonds, due in 1953, were priced at 95½ and interest to yield over 5.30 per cent. To meet the indebtedness incurred in the purchase of an interest in American Light & Traction common stock the United Light & Power Company floated a five-million-dollar loan in 5½ per cent gold notes, and the Sioux City Gas & Electric Company to raise funds for additions floated an issue of 5½ per cent gold bonds totaling $2,300,000.

During the week the Philadelphia Suburban Gas & Electric Company issued first and consolidated mortgage gold bonds to the amount of $2,100,000 at 98 and interest, yielding about 5.64 per cent. The bonds were dated February 1, 1925, and are due February 1, 1955. The proceeds will be used to reimburse the company in part for expenditures made for additions and extensions to its property and on account of underlying bonds retired through sinking funds. To provide in part the funds necessary to reimburse the company's treasury for capital expenditures recently made and soon to be made, the Great Western Power Company of California offered first and refunding mortgage sinking-fund gold bonds totaling $1,500,000 at 97½ and interest to yield 5¾ per cent. The Western United Corporation was represented with an issue of fifteen-year 6 per cent collateral gold notes, priced at 98, to yield over 6.20 per cent.

Commonwealth Edison Reports Successful Year

In the annual report recently issued the Commonwealth Edison Company reported one of the most successful periods in its history. On December 23, 1924, for the first time in its history, the company produced over 10,000,000 kw.-hr. in one day of twenty-four hours, thus establishing a record that surpasses the company's output for the entire year of 1893, which was World's Fair year. The exact output for the day was 10,491,600 kw.-hr. The electrical output for the year was 2,787,090,000 kw.-hr., as compared with 2,573,287,000 for 1923. The number of customers being served by the company on December 31, 1924, was 755,233, an increase during the year of 67,078.

In 1924 the company spent for extensions and improvements over $30,000,000, of which about 51 per cent was for generating station extensions and the remaining 49 per cent for other additions to the company's system. The net income for 1924, after all charges, was $9,107,919, equivalent to 11.69 per cent on the average capital stock of $77,878,600 outstanding during the year, or to 10.71 per cent on the $84,971,800 outstanding at the close of the year. Net income for 1923 was $7,552,117, equivalent to 11.21 per cent on the average capital stock of $67,362,525 outstanding, or to 10.49 per cent on the $72,000,000 outstanding at the end of the year. After paying dividends, last year produced a surplus of $2,877,631, which brought total surplus up to $15,563,361. The company increased its fixed assets by $27,581,000, miscellaneous assets by $3,534,000, and current assets by $3,326,000. Capital liabilities increased $29,458,000, current liabilities $285,000, and reserve $2,608,000. Total assets increased $35,144,000.

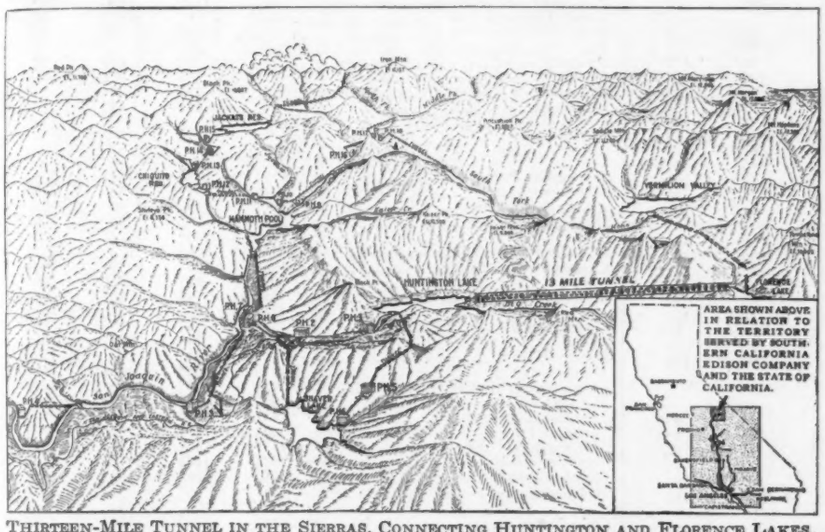
Customer-Ownership Campaign Is Closed.—Sale of the 7 per cent preferred stock of the Calumet Gas & Electric Company through the customer-ownership plan has closed. Fifteen thousand shares of this stock with a par value of $1,500,000 have been sold to customers, employees and other investors in less than three months, according to Charles W. Chase, vice-president of the company. The company today has 1,442 paid-up stockholders, and 2,260 others are buying the stock on the monthly savings plan. The stock is widely distributed, the average number of shares held being only four per stockholder. Sale of these securities began November 1, 1924, shortly after the Calumet Gas & Electric Company bought the properties of fourteen other public utilities in northern Indiana and consolidated them into one company.

Southern California Edison Progress

Completion of Lake Florence Tunnel Assures Complete Success of Big Creek Plans—Tremendous Growth in Twenty-three Years—Low Rates Prevail

BY PAUL WILLARD GARRETT

THE completion of the tunnel in the Sierras which will connect Huntington and Florence Lakes and play a great part in the Big Creek development plans of the Southern California Edison Company is an outstanding event in the history of that company. That the Southern California Edison expects great things from the project may be judged from the fact that already it has spent $17,000,000 on the Big Creek development, which before completion will cost considerably more than the Panama Canal. It means that dearth of snow or rain like that experienced last year cannot again limit very greatly the volume of output. Completion of the tunnel will swell the total watershed area serving Huntington Lake reservoir from 79 to 394 square miles.


HUNTINGTON LAKE
13 MILE TUNNEL
FLORENCE LAKE
MAMMOTH POOL
AREA SHOWN ABOVE IN RELATION TO THE TERRITORY SERVED BY SOUTHERN CALIFORNIA EDISON COMPANY AND THE STATE OF CALIFORNIA.

THIRTEEN-MILE TUNNEL IN THE SIERRAS, CONNECTING HUNTINGTON AND FLORENCE LAKES, RECENTLY COMPLETED BY THE SOUTHERN CALIFORNIA EDISON COMPANY

The benefits of the tunnel will mutliply during future years, but the saving in water supply that it will provide should add 253,000,000 kw.-hr. of production in 1925 alone. The engineers figure that Florence Lake Tunnel this year will increase the company's gross earnings by $3,250,000 and net by $2,450,000. The same amount of power generated by steam plants would, they say, cost $1,400,000 more.

LARGE EARNINGS AND LOW RATES

Investors in Southern California Edison securities already have witnessed a remarkable growth in the company's business, gross earnings having shown improvement in every year over the year before since 1900. Earning figures for 1924 are not yet available, but annual gross revenue increased from $226,143 in 1900 to $20,211,160 in 1923.

Several rate reductions have been put into effect since the peak of 1920, so that the company's rates now average lower than those prevailing before the war. In only a few industries can such a claim be made, and it has been possible in the case of the Southern California Edison Company largely as the result of expansion in its volume of business and economies in operation made possible by the great hydro-electric program.

To investors in power and light securities the Southern California Edison list affords numerous selections. The company's funded debt stands at $114,629,100, so that it has many bonds outstanding in the hands of the public, and these in general command a high investment rating. The capital structure also contains something over $74,000,000 in preferred and common.

Dividends Declared

The following dividends were announced by central-station companies and electrical manufacturing companies during the past week:

Name of Company	Per Cent	When Payable
Associated Gas & Electric, pf.	87½c	Apr. 1
Blackstone Valley Gas & Elec., com.	$1.25	Mar. 2
Cities Service, com., (monthly)	½	Apr. 1
Cities Service, com.*	½	Apr. 1
Cities Service, pf. and pf. B. (mthly)	½	Apr. 1
Consolidated Gas, El. Lt. & Power of Baltimore, com.	50c.	Apr. 1
Consolidated Gas, El. Lt. & Power of Baltimore, pf. A	2	Apr. 1
Consolidated Gas, El. Lt. & Power of Baltimore, pf. B	1¼	Apr. 1
Consolidated Gas, El. Lt. & Power of Baltimore, pf. C	$1.62	Apr. 1
Kentucky Hydro-Electric, pf.	1¼	Mar. 20
Lacled e Gas Light, com.	$2	Mar. 15
Northern Texas Electric, com.	$2	Mar. 2
Northern Texas Electric, pf. †	$3	Mar. 2
North American, com.	2½	Apr. 1
North American, pf.	1½	Apr. 1
Pennsylvania-Ohio Electric, pf.	1¾	Mar. 2
Philadelphia Company, com.	$1	Mar. 16
Public Service Elec. & Gas, 6% pf.	1½	Mar. 31
Shawinigan Water & Power	1¾	Apr. 10
Southern California Edison, 7% pf.	1¾	Mar. 15
Southern California Edison, 6% pf.	1½	Mar. 15
United Gas Improvement, pf.	1¾	Mar. 14
General Electric	2	Apr. 15
General Electric, special	15c	Apr. 15

* Payable in common stock.
† Semi-annual.

United Increases Capital Stock.—The stockholders of the United Electric Light & Power Company of New York have increased the authorized capital stock from 233,942 shares, consisting of 20,000 preferred, par $100, and 213,942 common, no par value, to 593,942 shares, consisting of 20,000 preferred, par $100, and 573,942 common, no par value.

San Joaquin Corporation Receives Authorization.—The California Railroad Commission has authorized the San Joaquin Light & Power Corporation to sell at not less than par $1,000,000 of 7 per cent cumulative preferred stock. The company has also received permission to use $400,000 from preferred stock previously authorized to retire a like amount of unifying and refunding 7 per cent bonds, due March 1.

Listings.—The New York Stock Exchange has authorized the listing of $12,500,000 general and refunding 5 per cent mortgage gold bonds, series A, of the Detroit Edison Company and $16,500,000 cumulative 8 per cent preferred stock of the Standard Gas & Electric Company.

P. G. & E. Files Application.—The Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to issue $2,500,000 additional common stock. Part of the funds will be used to meet an oversubscription on past authorization.

Ohio Utility to Issue Securities.—Permission to issue and sell or pledge $7,000,000 in bonds and notes has been requested of the Ohio Public Utilities Commission by the Northern Ohio Traction & Light Company, Akron. The company wants to sell $5,000,000 of bonds and issue $2,000,000 in two-year notes. The money is to be used to reimburse the company treasury for expenditures during the last few years on improvements, extensions and new property.

Utah Company Increase Capitalization.—Amended articles of incorporation increasing the capital stock of the Utah Power & Light Company from $60,000,000 to $65,000,000 have been filed in the office of the Secretary of State of Utah. There will be 200,000 shares of preferred, 100,000 shares of second preferred and 350,000 shares of common stock.

Tennessee Electric Reports Increase in Stockholders.—The Tennessee Electric Power Company reports that 50 per cent more people invested in its 7.20 per cent first preferred shares during December, 1924, than in December, 1923. The company's records show that 839 persons invested in this stock during December alone and that 1,487 persons in the Nashville district have become stockholders in the company during the past year. In the entire state the number of stockholders has grown during the year to a present total of 4,600 who have invested more than a million dollars in the company.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, Feb. 21	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	99	98	101
Appalachian Power, 7 per cent	96½	92	100
Arkansas Light & Power 7 per cent	94	92	98
Asheville Power & Light 7 per cent	*a* 99	99	100
Central Illinois Public Service 6 per cent	84½	84	87
Colorado Power 7 per cent	93	93	98
Connecticut Light & Power 7 per cent	105	105	110
Consumers' Power 6 per cent	90	90	93
Dayton Power & Light 6 per cent	94	88	100
Duquesne Light 7 per cent	104½	104	107
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	*a*101	100	102
Great Western Power 7 per cent	98	...	...
Illinois Northern Utilities 6 per cent	84	82	87
Illinois Power & Light 7 per cent	94	92½	98
Kansas Gas & Electric 7 per cent	*a* 98	98	100
Long Island Lighting 7 per cent	101	100	105
Minnesota Power & Light 7 per cent	*a* 96	96	98
Mississippi River Power 6 per cent	87½	87½	90
Nebraska Power 7 per cent	*a* 98	98	100
Niagara Falls Power 7 per cent—25	*a* 28½	28	29
Niagara, Lockport & Ont. Power 7 per cent	106	101½	110
Northern States Power 7 per cent	97	95	99
Ohio Public Service 7 per cent	97½	97	100
Pacific Gas & Electric 6 per cent	95	92	97
Pacific Power & Light 7 per cent	*a* 98	98	100
Penn-Ohio Power & Light 7 per cent	91½	91	97
Pennsylvania Power & Light $7—no par	*a*101½	100	102
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	41	40	44¾
Southern California Edison 8 per cent	116	115	120
Tennessee Electric Power, 6 per cent	82	80	84
Texas Power & Light 7 per cent	*a*100	100	101
Utah Power & Light 7 per cent	*a* 98½	98½	99½
Western States Gas & Electric 7 per cent	82	82	85
Yadkin River Power, 7 per cent	*a* 99	98	100
Holding Companies			
American Gas & Electric 6 per cent—50	45	45	47½
American Light & Traction	93½	93	95½
American Power & Light 6 per cent	87½	86	90
American Public Service 7 per cent	87	87	92
American Public Utilities 7 per cent	87	87	95
American Water Works & Electric 7 per cent	102	100	103
Associated Gas & Electric 7 per cent—1 per cent extra—50	*a* 50	...	...
Carolina Power & Light 7 per cent	100½	100	105
Central Indiana Power 7 per cent	88	88	93
Cities Service 6 per cent	81	80	83
Commonwealth Power 6 per cent	80½	80	82½
Consolidated Gas 6 per cent—50	57½	57½	58½
Continental Gas & Electric 7 per cent pr. pf	91	89	95
Electric Bond & Share 6 per cent	102	102	103½
General Gas & Electric—$8—no par	106	104½	110
*Middle West Utilities 7 per cent	94½	91½	94½
National Power & Light—$7—no par	97	95	99
North American 6 per cent—50	*a* 48	46½	48
Public Service Corp. of N. J. 7 per cent	101	99	102
Public Service Corp. of N. J. 8 per cent	111	110	112½
Standard Gas & Electric 8 per cent—50	52½	53	53¾
‡United Gas Improvement—50	58	57	58
United Light & Power—$6.50—no par	85	83	88
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	32	31	38
Appalachian Power—no par	76	70	83
Arkansas Light & Power	75	65	85
Brooklyn Edison	*a*127½	120½	133
Buffalo General Electric	235	197	245
Colorado Power	93	93	98
*Commonwealth Edison	137½	134½	139
§Consolidated Gas, Electric Light & Power	34	32	34
Dayton Power & Light	210	180	215
Detroit Edison	*a*115	110	115¾
|| Edison Electric Illuminating of Boston	200½	200	206
Kentucky Hydro-Electric	92½	85½	92½
Long Island Lighting	250	...	...
Mississippi River Power	37	37	40
Montana Power	*a*69	67½	72
Niagara Falls Power—no par	46	43	48
Niagara, Lockport & Ontario Power—no par	70	63	73
Northern Ohio Power—no par	6	5	7½
Northern States Power	104½	103	107
North Texas Electric	62	62	67
Pacific Gas & Electric	*a*107½	102½	108½
Penn Central Light & Power—no par	63¾	60	63¾
§Pennsylvania Water & Power	131½	126½	133½
‡Philadelphia Electric—25	41½	40½	45½
Public Service Co. of Northern Illinois	97	97	100
Puget Sound Power & Light	52	51	58
Southern California Edison	10	102	106
Tennessee Electric Power—no par	53	47	61
Virginia Power	70	70	92
Virginia Railway & Power	*a* 75½	64½	83
West Penn. Co.	116	110	120

Companies	Bid Price Saturday, Feb. 21	Low 1925	High 1925
Holding Companies			
American Gas & Electric—no par	73	72	80
American Light & Traction	148½	139	153
American Power & Light	54	54	67
American Public Utilities	75	75	85
American Water Works & Electric	*a* 38½	34½	39¾
Carolina Power & Light—no par	290	290	335
Cities Service	205	172	210
Columbia Gas & Electric—no par	*a* 49½	45¾	49¾
Commonwealth Power Corp.—no par	113	106	126
Consolidated Gas—no par	*a* 76¾	74¼	78¾
Continental Gas & Electric	84	80	88
Federal Light and Traction	135	114½	140
General Gas & Electric	73	72	81
Lehigh Power Securities—no par	96	82	116
*Middle West Utilities—no par	89½	82½	90
National Power & Light—no par	196	185	230
North American—10	*a* 47	41½	48¾
Philadelphia Co.—50	*a* 54½	52½	57½
Power Securities—no par	21	...	...
Public Service Corp. of N. J.—no par	*a* 70	67½	72
Standard Gas & Electric—no par	*a* 43½	40½	46
United Gas & Electric (Conn.)—no par	29	26	37½
Utah Securities	*a* 51½	41½	53
BONDS			
Operating Companies			
Adirondack Power & Light 6*a* 1950	103½	102½	103½
Alabama Power 5*s* 1946	97	96	97
Appalachian Power 5*s* 1941	97	96	97
Brooklyn Edison 5*s* 1949	99¼	99½	100
6*s* 1930	104½	104½	105
Cleveland Electric Illuminating 5*s* 1939	100½	100	101½
Commonwealth Edison 5*s* 1943	100	99½	100½
5*s* 1953	98¾	98½	99½
§Consol. Gas, Elec. Lt. & Pwr 4½*s* 1935	96½	95½	96½
6*s* 1949	106	104¾	106
Consumers' Power 5*s* 1936	99	99	99½
5*s* 1952	95	90¾	95½
Detroit Edison 5*s* 1933	101	100	102¼
Duquesne Light 6*s* 1949	105¾	105	106½
Great Western Power 5*s* 1946	96¾	95	97¼
Kansas City Power & Light 5*s* 1952	96½	95½	97¼
Mississippi River Power 5*s* 1951	97½	96½	97½
Montana Power 5*s* 1943	99½	97½	99½
New England Power 5*s* 1951	100¾	100¾	101¾
New York Edison 6½*s* 1941	114½	112¾	115
Niagara Falls Power 6*s* 1950	106½	105	106½
Northern States Power 5*s* 1941	95¾	93	95¾
6*s* 1941	105	103	105½
Ohio Power 7*s* 1951	106½	106¼	107½
Pacific Gas & Electric 5*s* 1942	95¾	93½	95¾
Pennsylvania Water & Power 5*s* 1940	100	99½	100½
‡Philadelphia Electric 5*s* 1966	101¾	100½	102
5½*s* 1947	104¾	103½	104¾
6*s* 1941	106¾	106	107
Portland Electric Power 6*s* 1947	*a* 99	94	99¼
Southern California Edison 5*s* 1939	99½	99½	100
6*s* 1944	102½	102½	103½
Tennessee Electric Power 6*s* 1947	*a*101½	99½	101½
Texas Power & Light 5*s* 1937	97½	97	98
Toledo Edison 7*s* 1941	*a*109¾	108½	109¾
Utah Power & Light 5*s* 1944	*a* 87	...	...
Holding Companies			
Alabama Traction, Light & Power 5*s* 1962	86	86	87½
American Gas & Electric 6*s* 2014	96½	96½	97
American Power & Light 6*s* 2016	95	94	95
Amer. Water Works & Electric 5*s* 1934	95¾	92½	96¾
Associated Gas & Electric 6½*s* 1954	*a* 98½	...	...
Central Indiana Power 6*s* 1947	98	95½	98
Commonwealth Power 6*s* 1947	100½	97¾	101
Consolidated Cities Lt., Pwr. & Tr. 5*s* 1962	78	75½	78½
Illinois Power & Light 6*s* 1953	101	100½	101½
United Light & Railways 5*s* 1932	95	93½	95
6*s* 1952	97½	95¾	97½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	104½	103¾	107
Worthington Pump & Machinery A	85½	85	88
COMMON STOCKS			
Allis-Chalmers Manufacturing	*a* 76	71½	82¾
American Bosch Magneto—no par	*a* 41½	33	54½
Electric Storage Battery—no par	*c* 65½	62½	70¾
General Electric	*a*239	227½	320
General Electric—10	*a* 11¾	11	11½
*Hurley Machine—no par	49½	47	56
†Wagner Electric	41	26½	50
Westinghouse Electric & Manufacturing—50	*a* 73½	69¾	84
Worthington Pump & Machinery	*a* 71½	62½	79¾
BONDS			
Canadian General Electric 6*s* 1942	107½	107½	107⅞
General Electric 3½*s* 1942	82½	82¼	84
5*s* 1952	103	101½	105½
Robbins & Myers 7*s* 1952	68	67	73½
Western Electric 5*s* 1944	99	98½	99½
Westinghouse Electric & Mfg 7*s* 1931	107⅞	107¼	108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price Tuesday, February 24.